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TG410 User Manual

TOUGHSeries
Digital Generator Controllers

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User Guide

1 Introduction

The TOUGH series controllers are designed to provide complete control, protection, AC metering, and engine instrumentation for both standard and electronic engines. The module is easily configured using either the front panel buttons or our DYNAGEN Configurator software. TOUGH series controllers are ideally suited for severe duty applications where reliability is critical such as mobile and stationary generators.

Tier 4 Ready

Features and Functions:

- 5 Year Warranty
- SAE J1939 CAN Bus Protocol
- RPM via J1939, Magnetic Pickup, or Generator
- Speed control offset for electronic engines
- Autostart on low battery and other sensors
- Trim feature for AC monitoring and sensors
- Maintenance counter
- Exerciser Clock
- 150 Event Log
- Conformally coated for protection against moisture
- Gasket for water ingress protection resistance
- Free RapidCore Configuration Software
- Fast and rugged installation clips
- Passcode protected
- Automatic shutdowns and warnings
- Manual and Remote start
- Momentary Start / Stop inputs
- Pre-heat and many other configurable timers
- Accepts common senders (VDO, Datcon, S&W)
- Custom senders configurable with DYNAGEN Configurator

Displays:

- Engine Temperature
- Oil Pressure
- Fuel Level
- Engine Speed
- AC Metering
- Battery Voltage
- Real Time Clock
- Engine Hours
- Time to Maintenance
- J1939 DTCs + Custom Text
- Custom Senders
- Warnings and Failures

Feature	Included
DPF / DEF Ready	✓
J1939 CAN Bus	✓
Isolated RS485 Modbus	✓
Magnetic Pickup Input	✓
150 Event Log	✓
Clock / Exerciser	✓
Generator Voltage Metering	Single or 3-Phase
Generator Current Metering (with IDMT and Load Imbalance features)	Single or 3-Phase
Configurable Switched Inputs	5
Resistive Sensors (1 High □, 1 Low □)	2
Universal Sensor (Resistive, 0-5V, 4-20mA)	2
5V Sensor Output for Electronic Sensors	✓
Configurable Switched Outputs	6

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1.1 Specifications

The TOUGH Series controllers were rigorously tested to ensure durability, reliability and functionality. The following specifications are a brief summary of the standards to which the controller has been tested. For complete details on the testing performed please contact DYNAGEN.

Testing Specifications

Specification	Rating
Electrical Transients	SAE1113-11
Thermal Shock and Cycling	SAE1455
Vibration Profiles	SAE1455
Electric Static Discharge	SAE1113-13
UL	c UL us UL 6200 recognized component. Consult factory for UL conditions of acceptability.

Physical Specifications

Specification	Rating
Operating Temperature	-40 to +158°F (-40 to +70°C)
LCD Viewing Temperature	-4 to +158°F (-20 to +70°C) (Optional heater available, call factory)
Weight Weight w/ RelayPak	0.83lb (0.38kg) 1.32lb (0.60kg)
Dimensions - no gasket - no gasket and relay pack - with gasket and relay pack	4.17" x 6.50" x 1.38" (10.59cm x 16.51cm x 3.51cm) 4.41" x 6.79" x 1.38" (10.59cm x 16.51cm x 8.46cm) 4.41" x 6.79" x 3.33" (11.20cm x 17.25cm x 8.46cm)

Electrical Specifications

Specification	Rating
Operating Voltage	5.5 ~ 36 VDC
Standby Current	60mA @ 12V 38mA @ 24V
Switched Inputs	+Battery, Ground, Open
Switched Outputs	+Battery @ 1A Max
Low Resistance Sensors	0 ~ 750Ohm
High Resistance Sensors	0 ~ 7,500Ohm
Universal Sensors	0 ~ 750Ohm, 0 ~ 7,500Ohm, 0 ~ 5 VDC, 4 ~ 20mA
Magnetic Pickup	10 ~ 10,000Hz at 1 ~ 50 VAC
AC Voltage (Line-To-Line)	50 ~ 600 VAC True RMS, Accuracy: 2% Full Scale. Do not connect more than 600VAC to the controller. Damage may result.
AC Current (TG410 only)	0 ~ 5A (Current Transformer), Accuracy: 1% Full Scale
Communications	SAE J1939 (Tier II, III, IV) Isolated RS485 (Slave Modbus RTU)

2 Installation

Generator systems contain high voltage circuitry and precautions to protect against electrical shock should be taken. Failing to power down and lock out equipment can cause damage, injury or death.

⚠ **WARNING**: Wiring of this controller should be performed by qualified electricians only.

The following general electrical safety precaution should be followed:

- Do a thorough inspection of the area before performing any maintenance.
- Keep fluids away from electrical equipment.

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- Unplug connectors by pulling on the plug and not the cord.
- Use fuses where appropriate.
- Ensure all equipment is properly grounded.
- Provide support to wires to prevent stress on terminals.

To ensure proper and safe operation, caution must be taken at the installation site to make sure it is free from excessive moisture, fluctuating temperature, dust and corrosive materials. Choose a mounting surface with the least amount of vibration and not more than **0.125" (3.175mm)** thick.

1) Choose a suitable mounting location based on the criteria above.

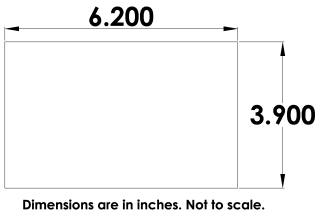
2) Create a rectangular cutout in the panel that is minimum 3.9" (99mm) high and 6.2" (158mm) wide.

3) Place the controller into the panel cutout so that the LCD screen and buttons are facing out.

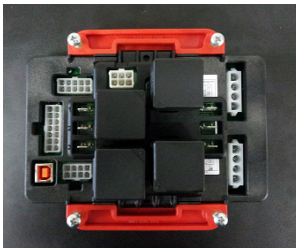
4) Place the mounting clips into the designated slots on the top and bottom of the controller.

5) Tighten the screws on the clips until the controller is snug against the panel. Do not overtighten, the bottom of the screws should angle very slightly away from the controller.

6) If applicable, snap the RelayPak (RP100) to the back of the controller. Place one side of the RP100's tabs into the slot on the back of the controller and, without pushing on the relays, snap the other tab into place.



Dimensions are in inches. Not to scale.



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2.1 General Wiring Notes

The following wiring guidelines should be followed:

1. Use a minimum of 18AWG wire for all connections.
2. Battery + and Battery - connections on the controller should be run directly to the positive and negative terminals on the battery to prevent voltage drops from negatively impacting the controller.
3. Limit the wire length to 20ft (6.1m) to any I/O on the controller (e.g. Switched Input, Switched Outputs, AC Sensing, and Analog Inputs).
4. It is good practice to run the AC voltage sensing wiring to the controller in a separate conduit from the AC current sensing wiring. If the AC voltage is especially noisy (e.g. variable frequency drives) then they MUST be run separately.

The following enclosure guidelines should be followed:

1. It is recommended to use vibration mounts.
2. For outdoor applications, it is recommended to use a sealed enclosure.

For noisy environments some guidelines are:

1. Replace speed sensing wire with twisted pair from sensor/genset to controller.
2. If sensor readings are or may be affected consider using isolated sensors (i.e. two terminal) and use twisted pair wiring to connect from engine to controller.

2.2 Terminal Descriptions

Main Connector (J4)

Terminal	Name	Description
J4-1	+Battery	Provides power to the controller from the battery
J4-2	+Battery	Provides power to the controller from the battery
J4-3	Ground	Provides ground return for the controller
J4-4	Ground	Provides ground return for the controller
J4-5	Switched Input A	Configurable to detect +Battery, Ground, or Open
J4-6	Switched Input B	Configurable to detect +Battery, Ground, or Open
J4-7	Switched Input C	Configurable to detect +Battery, Ground, or Open
J4-8	Switched Output A	Outputs +Battery voltage when active (Max Current: 1A)
J4-9	Switched Output C	Outputs +Battery voltage when active (Max Current: 1A)
J4-10	Switched Output B	Outputs +Battery voltage when active (Max Current: 1A)
J4-11	Sensor Ground	Provides ground return for 2-wire (isolated) sensors
J4-12	Sensor Input A	High impedance sensor input (0 - 7,500Ohm)
J4-13	Sensor Input B	Low impedance sensor input (0 - 750Ohm)
J4-14	Sensor Input C	Universal sensor input (0 - 750Ohm, 0 - 7,500Ohm, 0 - 5 VDC, 4 - 20mA). See Universal Sensor section for more information.

Expansion Connector (J3)

Terminal	Name	Description
J3-1	Switched Input D	Configurable to detect +Battery, Ground, or Open
J3-2	Switched Input E	Configurable to detect +Battery, Ground, or Open
J3-3	Switched Output D	Outputs +Battery voltage when active (Max Current: 1A)
J3-4	Switched Output E	Outputs +Battery voltage when active (Max Current: 1A)
J3-5	Switched Output F	Outputs +Battery voltage when active (Max Current: 1A)
J3-6	Sensor 5V	Provides 5 VDC for electronics sensors.

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Terminal	Name	Description
J3-7	Sensor Ground	Provides ground return for 2-wire sensors
J3-8	Sensor Input D	Universal sensor input (0 - 750Ohm, 0 - 7,500Ohm, 0 - 5 VDC, 4 - 20mA) See Universal Sensor section for more information.

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Communications Connector (J6)

Terminal	Name	Description
J6-1	RS485-A	Communications line for Modbus (RS485)
J6-2	RS485-B	Communications line for Modbus (RS485)
J6-3	No Connection	No Connection
J6-4	CAN-H	Communications line for CAN Bus (J1939)
J6-5	CAN-L	
J6-6	CAN-Shield	Connect the shield of the twisted pair cable to this terminal
J6-7	Speed Sensing A	Connect to a magnetic pickup, tachometer, or a flywheel alternator. Not polarity sensitive and not required if using AC voltage terminals for speed sensing.
J6-8	Speed Sensing B	Connect to a magnetic pickup, tachometer, or a flywheel alternator. Not polarity sensitive and not required if using AC voltage terminals for speed sensing.
J6-9	No Connection	No Connection
J6-10	RS485-Common	Common line for Modbus (RS485)

Generator AC Voltage (J7)

Terminal	Name	Description
J7-1	Phase A	Connect to Phase A of the generator
J7-2	Phase B	Connect to Phase B of the generator
J7-3	Phase C	Connect to Phase C of the generator
J7-4	Neutral	Connect to neutral.

Generator AC Current (J5)

Terminal	Name	Description
J5-1	Phase A	Connect to current transformer for Phase A of the generator
J5-2	Phase B	Connect to current transformer for Phase B of the generator
J5-3	Phase C	Connect to current transformer for Phase C of the generator
J5-4	CT Common	Connect to the commons of the current transformers

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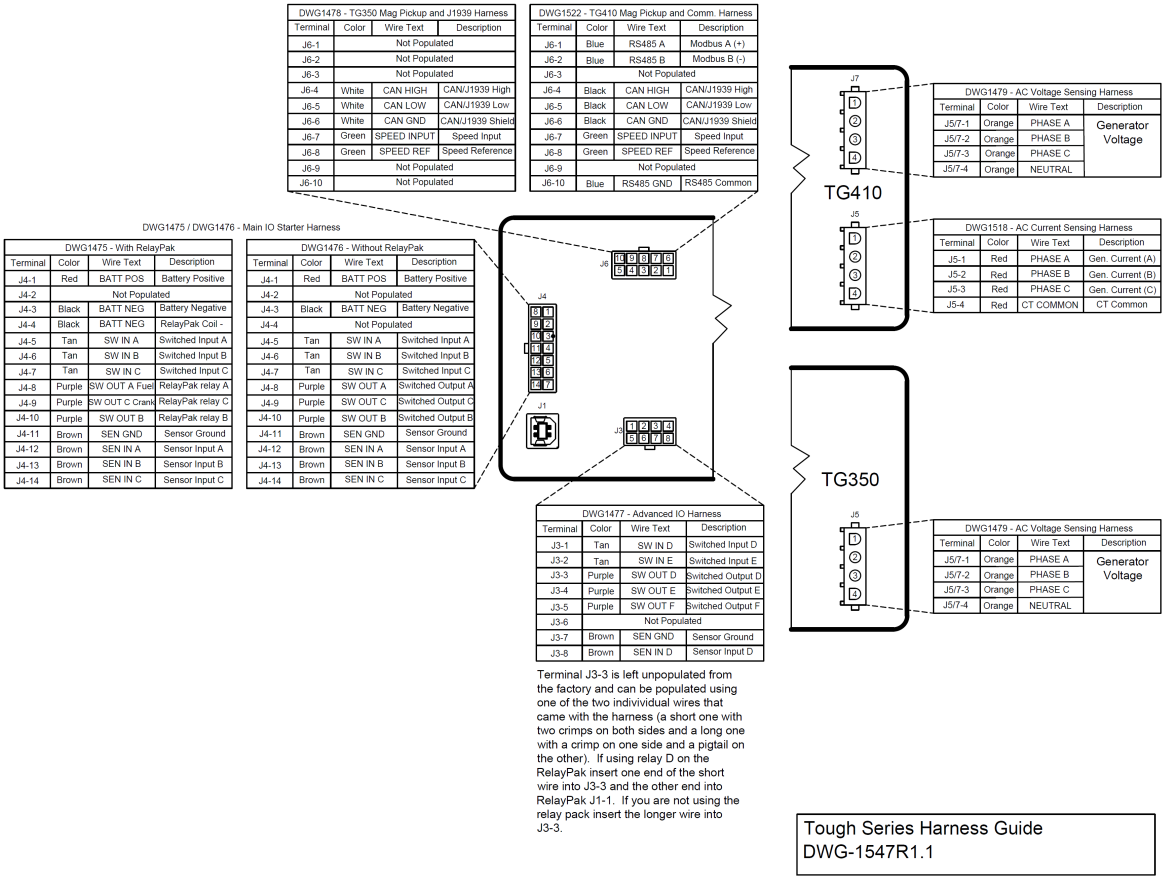
2.3 Wiring Harnesses



DWG1478 - TG350 Mag Pickup and J1939 Harness

Terminal	Color	Wire Text	Description
J6-1	Not Populated		
J6-2	Not Populated		
J6-3	Not Populated		
J6-4	White	CAN HIGH	CAN/J1939 High
J6-5	White	CAN LOW	CAN/J1939 Low
J6-6	White	CAN GND	CAN/J1939 Shield
J6-7	Green	SPEED INPUT	Speed Input
J6-8	Green	SPEED REF	Speed Reference
J6-9	Not Populated		
J6-10	Not Populated		

DWG1522 - TG410 Mag Pickup and Comm. Harness

Terminal	Color	Wire Text	Description
J6-1	Blue	RS485 A	Modbus A (+)
J6-2	Blue	RS485 B	Modbus B (-)
J6-3	Not Populated		
J6-4	Black	CAN HIGH	CAN/J1939 High
J6-5	Black	CAN LOW	CAN/J1939 Low
J6-6	Black	CAN GND	CAN/J1939 Shield
J6-7	Green	SPEED INPUT	Speed Input
J6-8	Green	SPEED REF	Speed Reference
J6-9	Not Populated		
J6-10	Blue	RS485 GND	RS485 Common

DWG1475 / DWG1476 - Main IO Starter Harness

DWG1475 - With RelayPak

Terminal	Color	Wire Text	Description
J4-1	Red	BATT POS	Battery Positive
J4-2	Not Populated		
J4-3	Black	BATT NEG	Battery Negative
J4-4	Black	BATT NEG	RelayPak Coil -
J4-5	Tan	SW IN A	Switched Input A
J4-6	Tan	SW IN B	Switched Input B
J4-7	Tan	SW IN C	Switched Input C
J4-8	Purple	SW OUT A Fuel	RelayPak relay A
J4-9	Purple	SW OUT C Crank	RelayPak relay C
J4-10	Purple	SW OUT B	RelayPak relay B
J4-11	Brown	SEN GND	Sensor Ground
J4-12	Brown	SEN IN A	Sensor Input A
J4-13	Brown	SEN IN B	Sensor Input B
J4-14	Brown	SEN IN C	Sensor Input C

DWG1476 - Without RelayPak

Terminal	Color	Wire Text	Description
J4-1	Red	BATT POS	Battery Positive
J4-2	Not Populated		
J4-3	Black	BATT NEG	Battery Negative
J4-4	Not Populated		
J4-5	Tan	SW IN A	Switched Input A
J4-6	Tan	SW IN B	Switched Input B
J4-7	Tan	SW IN C	Switched Input C
J4-8	Purple	SW OUT A	Switched Output A
J4-9	Purple	SW OUT C	Switched Output C
J4-10	Purple	SW OUT B	Switched Output B
J4-11	Brown	SEN GND	Sensor Ground
J4-12	Brown	SEN IN A	Sensor Input A
J4-13	Brown	SEN IN B	Sensor Input B
J4-14	Brown	SEN IN C	Sensor Input C

DWG1477 - Advanced IO Harness

Terminal	Color	Wire Text	Description
J3-1	Tan	SW IN D	Switched Input D
J3-2	Tan	SW IN E	Switched Input E
J3-3	Purple	SW OUT D	Switched Output D
J3-4	Purple	SW OUT E	Switched Output E
J3-5	Purple	SW OUT F	Switched Output F
J3-6	Not Populated		
J3-7	Brown	SEN GND	Sensor Ground
J3-8	Brown	SEN IN D	Sensor Input D

Terminal J3-3 is left unpopulated from the factory and can be populated using one of the two indivividual wires that came with the harness (a short one with two crimps on both sides and a long one with a crimp on one side and a pigtail on the other). If using relay D on the RelayPak insert one end of the short wire into J3-3 and the other end into RelayPak J1-1. If you are not using the relay pack insert the longer wire into J3-3.

TG410

DWG1479 - AC Voltage Sensing Harness

Terminal	Color	Wire Text	Description
J5/7-1	Orange	PHASE A	Generator Voltage
J5/7-2	Orange	PHASE B	
J5/7-3	Orange	PHASE C	
J5/7-4	Orange	NEUTRAL	

DWG1518 - AC Current Sensing Harness

Terminal	Color	Wire Text	Description
J5-1	Red	PHASE A	Gen. Current (A)
J5-2	Red	PHASE B	Gen. Current (B)
J5-3	Red	PHASE C	Gen. Current (C)
J5-4	Red	CT COMMON	CT Common

TG350

DWG1479 - AC Voltage Sensing Harness

Terminal	Color	Wire Text	Description
J5/7-1	Orange	PHASE A	Generator Voltage
J5/7-2	Orange	PHASE B	
J5/7-3	Orange	PHASE C	
J5/7-4	Orange	NEUTRAL	

Tough Series Harness Guide
DWG-1547R1.1

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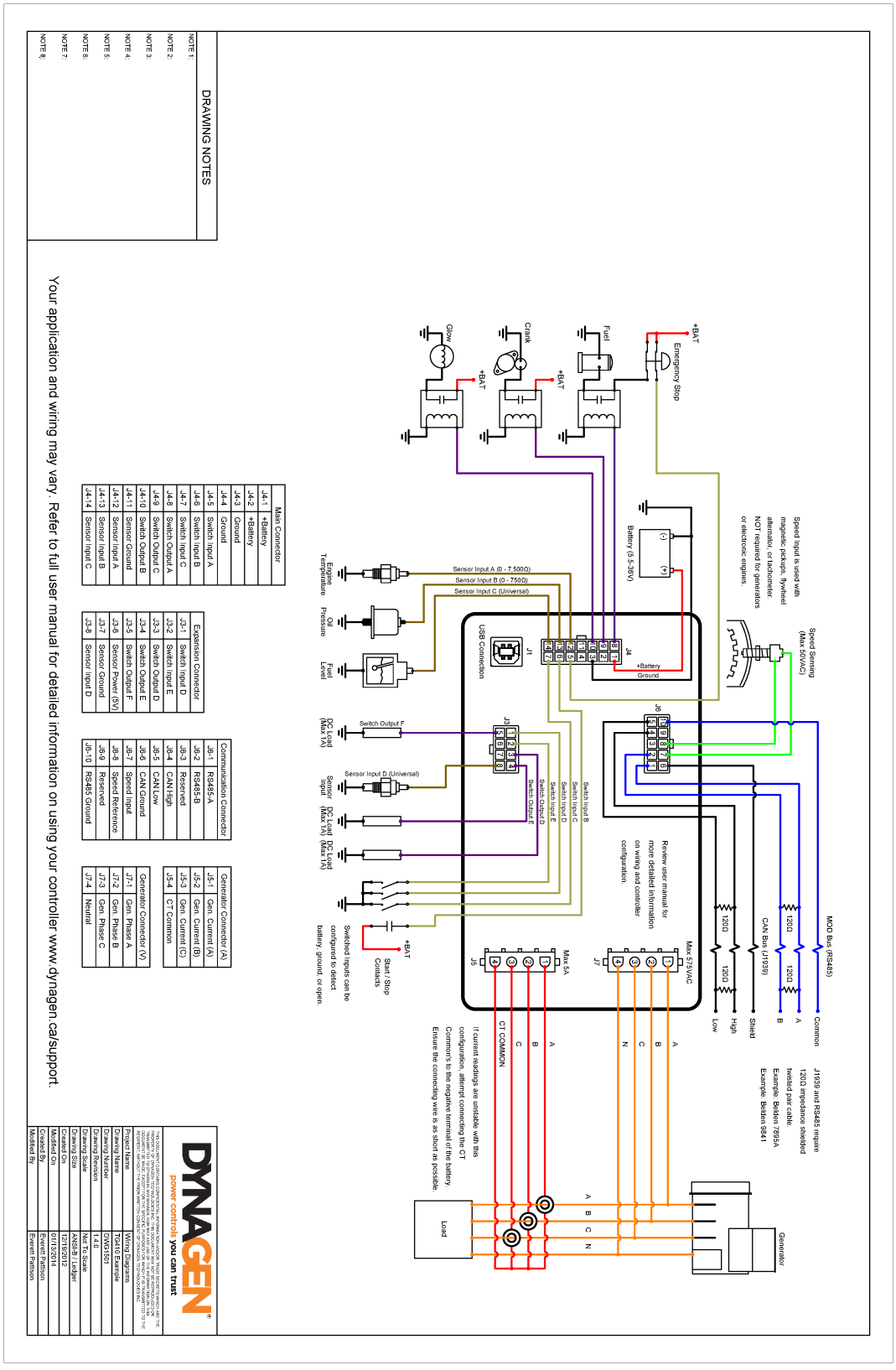
2.4 Typical Wiring Diagram



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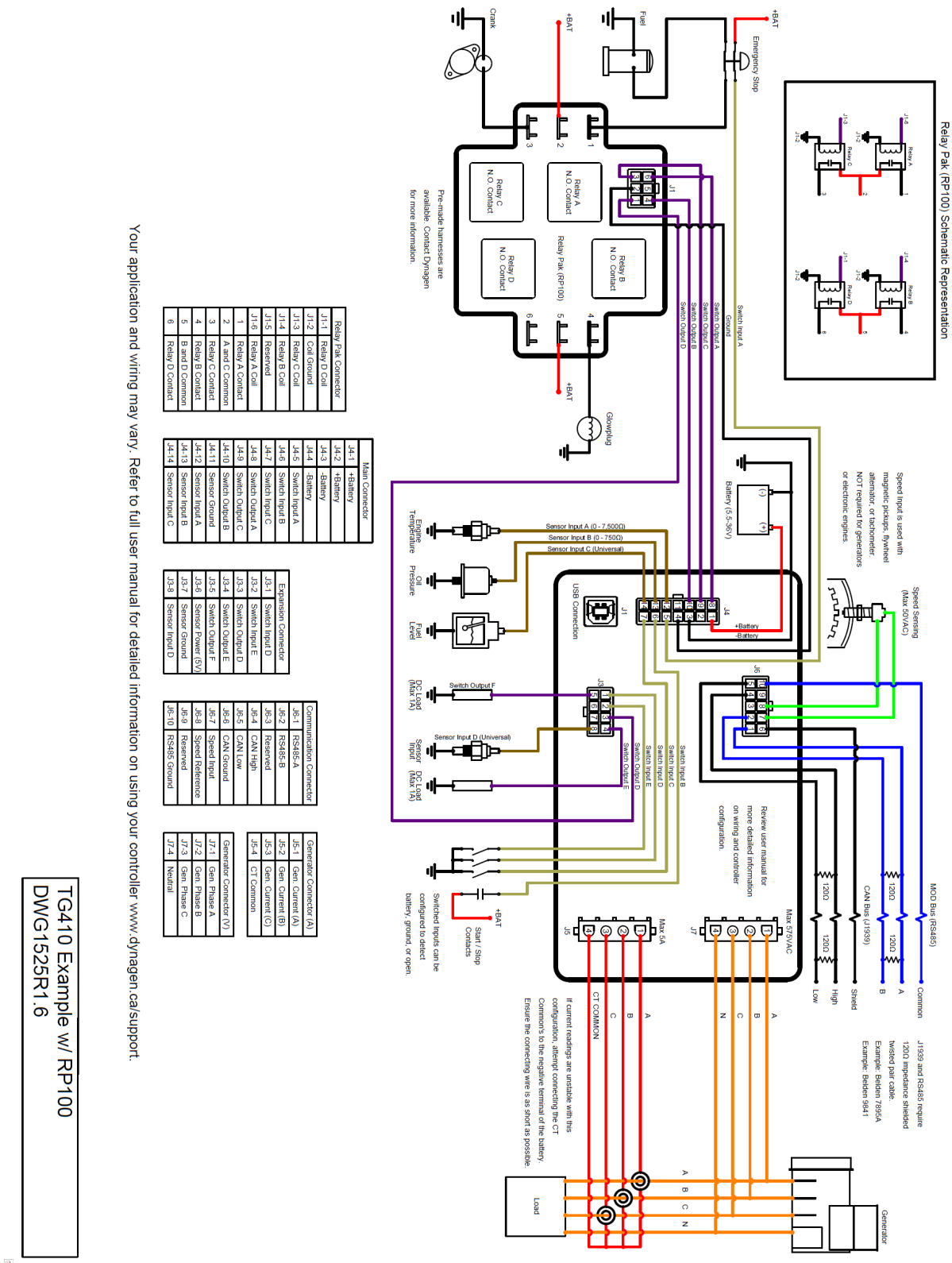
2.5 Typical Wiring Diagram with RelayPak



Relay Pak Connector	
J1-1	Relay D Coil
J1-2	Coil Ground
J1-3	Relay C Coil
J1-4	Relay B Coil
J1-5	Reserved
J1-6	Relay A Coil
1	Relay A Contact
2	A and C Common
3	Relay C Contact
4	Relay B Contact
5	B and D Common
6	Relay D Contact

Main Connector	
J4-1	+Battery
J4-2	+Battery
J4-3	-Battery
J4-4	-Battery
J4-5	Switch Input A
J4-6	Switch Input B
J4-7	Switch Input C
J4-8	Switch Output A
J4-9	Switch Output C
J4-10	Switch Output B
J4-11	Sensor Ground
J4-12	Sensor Input A
J4-13	Sensor Input B
J4-14	Sensor Input C

Expansion Connector	
J3-1	Switch Input D
J3-2	Switch Input E
J3-3	Switch Output D
J3-4	Switch Output E
J3-5	Switch Output F
J3-6	Sensor Power (5V)
J3-7	Sensor Ground
J3-8	Sensor Input D

Communication Connector	
J6-1	RS485-A
J6-2	RS485-B
J6-3	Reserved
J6-4	CAN High
J6-5	CAN Low
J6-6	CAN Ground
J6-7	Speed Input
J6-8	Speed Reference
J6-9	Reserved
J6-10	RS485 Ground

Generator Connector (A)	
J5-1	Gen. Current (B)
J5-2	Gen. Current (B)
J5-3	Gen. Current (C)
J5-4	CT Common

Generator Connector (Y)	
J7-1	Gen. Phase A
J7-2	Gen. Phase B
J7-3	Gen. Phase C
J7-4	Neutral

Your application and wiring may vary. Refer to full user manual for detailed information on using your controller www.dynagen.ca/support.

TG410 Example w/ RP100
DWG1525R1.6

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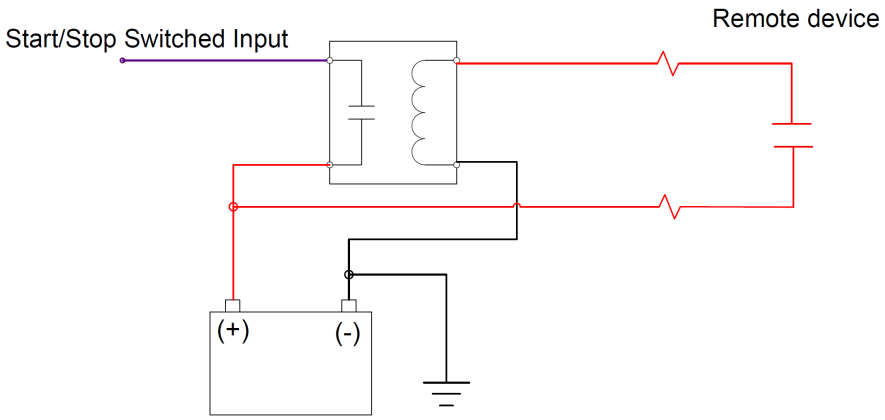
2.6 Wiring Considerations

The following sections are meant to describe certain wiring configurations for illustrative purposes only. Not all applications are the same. Please ensure you modify these examples to fit your unique system requirements.

2.6.1 Remote Start Contact (Start/Stop)

As of Firmware version 1.60 the start/stop is factory defaulted to switch input B (changeable) and the trigger factory defaulted to Close +BAT. For older firmware versions you must set Start/Stop to Switched Input B or as desired and set the trigger mode to Close +BAT. The trigger can be set to any of four options but Close +BAT gives the best immunity to noise.

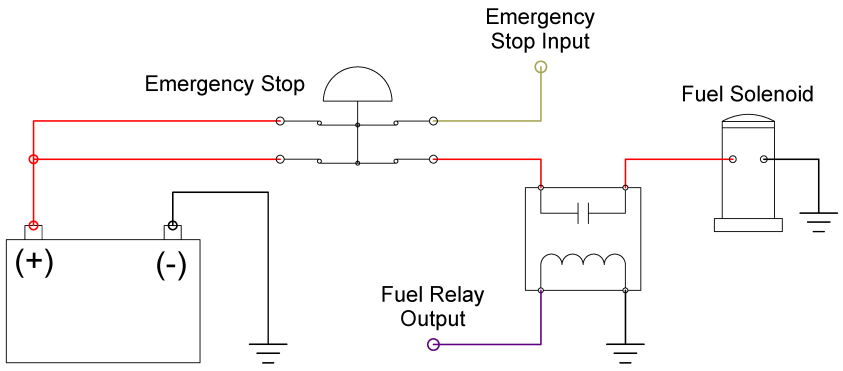
For runs over 20ft (6.1m) especially in noisy environments Dynagen recommends connecting the Start/Stop to an external relay. The relay needs to be located as close to the controller as possible.



2.6.2 Emergency Stop Wiring

If Emergency Stop functionality is required, it is mandatory to install an external mushroom style switch wired in series with the fuel or ignition supply to ensure reliable and immediate shutdown upon activation.

Shown below is an example wiring diagram of a double pull, single throw switch being used to activate the e-stop input and cut power to the fuel solenoid. In this configuration, the e-stop is activated when there is an open circuit to the switched input and inactive when the input detects +Battery voltage.



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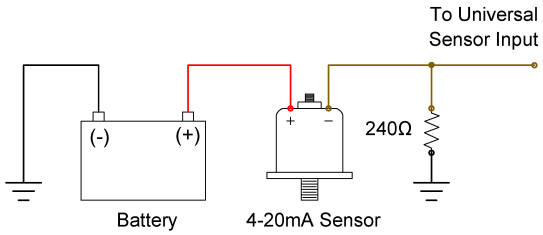
2.6.3 Universal Sensor

Universal Sensors have the ability to be configured to detect different sender types (0 - 750Ohm, 0 - 7,500Ohm, 0 - 5 VDC, 4 - 20mA). The examples shown below are advanced applications of the universal sensor.

NOTE: Custom Sensor tables are required for the universal sender to work with these examples. See the Custom Sender Table section for more information.

Example #1: The following example shows the correct way for wiring a 4-20mA sensor. The 240Ohm resistor is required to transform the 4-20mA current into the 0-5V voltage range required by the controller.

4-20mA Wiring Example



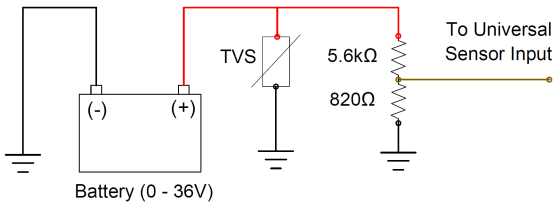
Example #2: Sometimes it is required to measure voltages outside the 0-5V range allowed by the controller. To do this you must use a voltage divider with appropriate scaling resistors. The equation to calculate the resistor values is as follows:

$$Vout = \left(\frac{R1}{R1 + R2}\right) \times Vin$$

Vout = 5V
Vin = Maximum Voltage to Read
R1 = Common Resistor Value > 10kOhm
R2 = Calculated Resistor Value (Select closest common resistor value)

The following diagram shows the typical wiring of a voltage divider. The resistors' values have been selected to allow the controller to read up to 36V from an external battery bank.

0-36V Wiring Example



NOTE: A TVS (i.e. varistor) is required if the battery is different than the battery the controller is powered from. The controller's TVS cannot protect the sensor input from transients in this case.

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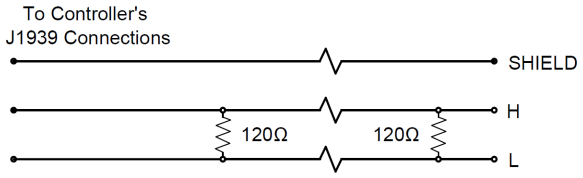
2.6.4 CAN Bus Wiring

The following table outlines some items that must be taken into consideration when connecting to a CAN bus engine.

Consideration	Description
Bus Termination	Each end of the bus must be terminated from CAN H to CAN L with 120Ohm +/- 10 Ohm resistors. The resistor must be able to handle at least 400mW of power disipation.
Cable Selection	A twisted pair 120Ohm cable is required for communications. For better protection a shielded twisted pair cable is recommended. Examples are: 1. Belden 9841 - One twisted pair, 24AWG 2. Belden 7895A - Two twisted pair, 20AWG, second pair can be used for power
Shielding	If using a shielded cable the shield must be connected to ground on one end of the bus only. This prevents loss of data from electromagnetic interference.

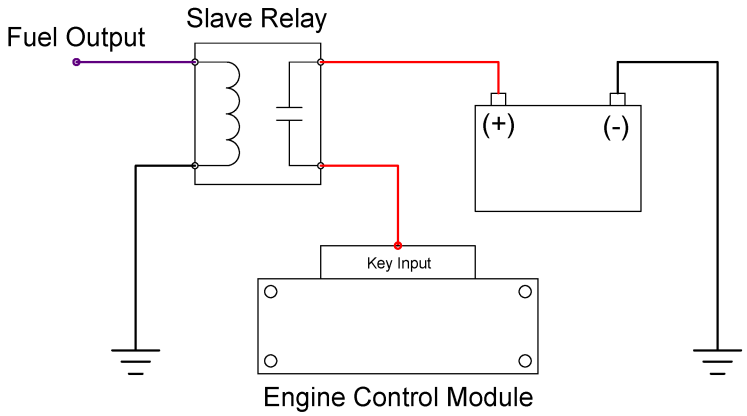
Communications Wiring



For the ECM to function, it must first receive power for a short time before cranking to allow it to boot up. It is common practice to connect the fuel relay output to a slave relay to trigger the key input of the ECM. There are two ways to configure this:

- The fuel relay is on during Preheat therefore increasing the Preheat time in the Engine Logic menu will allow longer time for the ECM to boot up before cranking; or,
- Turning on the Auto Power ECM setting in the Communications -> CAN Bus (J1939) menu enables the fuel relay to be on when controller is in Auto mode. This way the ECM will be always be on except when the controller is in the OFF mode.

ECM Wiring



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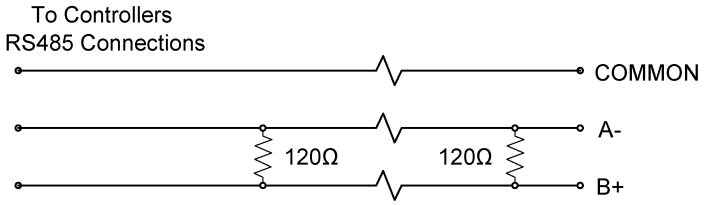
2.6.5 Modbus Wiring

The following table outlines some items that must be taken into consideration when connecting up a Modbus system.

Consideration	Description
Bus Termination	Each end of the bus must be terminated from A to B with 120Ohm resistors. If the controller is a device that is not at the end of the bus, it does not require a terminating resistor.
Cable Selection	RS485 twisted pair 120Ohm cables are required for communications. It is recommended that the sheild drain wire (if using a shielded cable) NOT be used for the RS485 common. If the cable doesn't have a spare wire run a separate wire at least 24AWG. Examples: 1. Belden 9841 - One twisted pair, 24AWG. A separate wire must be run for RS485 common. 2. Belden 7895A - Two twisted pair, 20AWG, second pair can be used for the RS485 common or remote device power. If powering a remote device need to run a seperate wire for modbus common.
Distance (Power and Ground)	If running power and ground from the battery of your system to a remote device, use the following guidelines for the gauge of the power and ground wires. 1. Up to 450ft (137.2m) - 22AWG 2. Up to 700ft (213.4m) - 20AWG 3. Up to 1125ft (342.9m) - 18AWG 4. Up to 1800ft (548.6m) - 16AWG 5. Up to 2800ft (853.4m) - 14AWG

Communications Wiring



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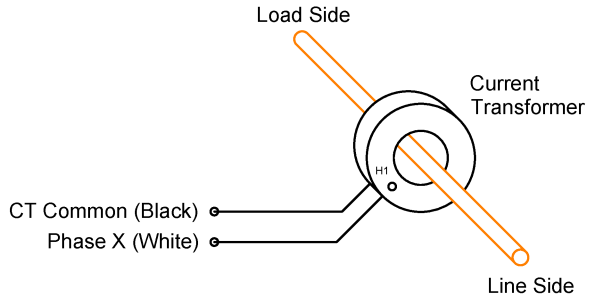
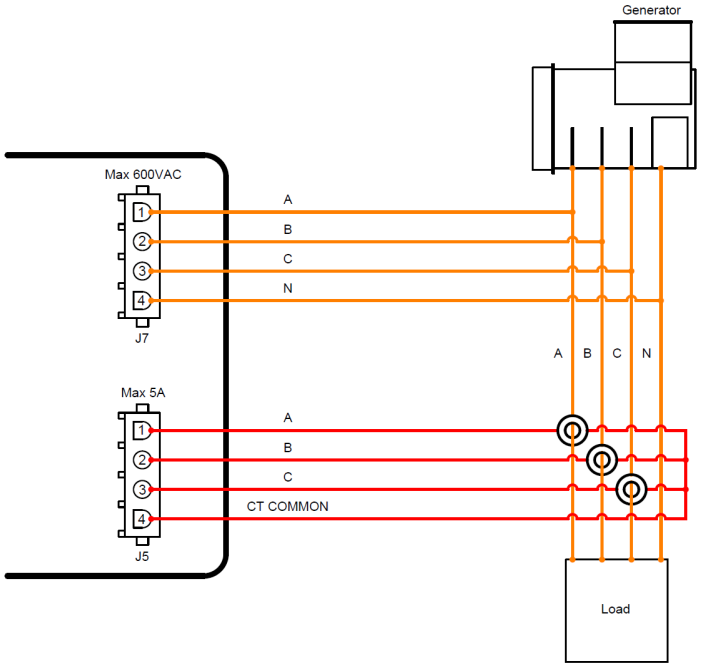
2.6.6 Current Transformers

When wiring current transformers into the system you must follow these considerations:

1. The current transformer of each phase must be facing the same direction. See below.
2. The CT Common connection must be connected to the black wire on each current transformer.
3. The wires from the current transformers to the controller should be as short as possible.

NOTE: If readings are unstable with the configuration shown below, attempt connecting the CT Common's black wire to the negative terminal of the battery. Ensure the connecting wire is as short as possible.





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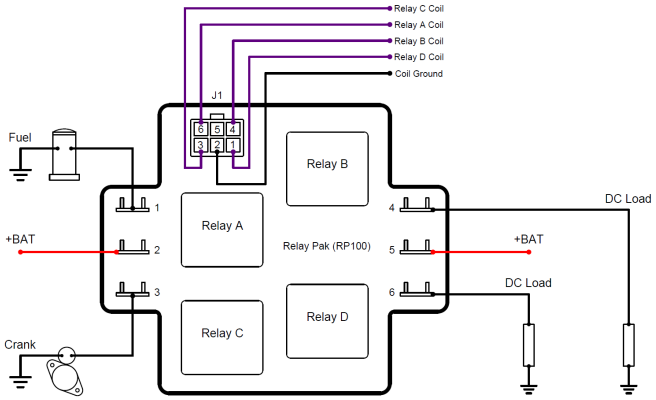
2.6.7 RelayPak (Optional)

The RelayPak is used to provide built-in slave relays in a compact and easy to wire package. This allows the low current outputs of the controller to switch on high current relays on the RelayPak.

Electrical Specifications

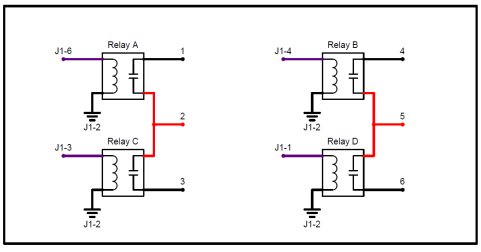
Specification	Rating
Operating Voltage	12V / 24V
Output Pilot Duty Rating	5.83A Per Relay @ 12V
Output Resistive Rating	10A Continuous Per Relay @ 12V 40A Momentary Per Relay @ 12V
Relay Style	Automotive Cube
Standards	c UL us UL 6200 recognized component. Consult factory for UL conditions of acceptability.

WARNING: You must use relays in the RelayPak that are suitable for the system voltage. Example: 12V relays in a 12V system and 24V relays in a 24V system.



Schematic Representation

Relay Pak Connector	
J1-1	Relay D Coil
J1-2	Coil Ground
J1-3	Relay C Coil
J1-4	Relay B Coil
J1-5	
J1-6	Relay A Coil
1	Relay A Contact
2	A and C Common
3	Relay C Contact
4	Relay B Contact
5	B and D Common
6	Relay D Contact



3 Using the Controller

The LCD display is the primary source of information from the controller. It allows you to view/change settings and monitor the status of sensors and other engine peripherals.

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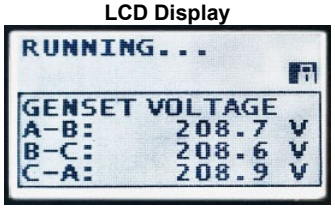
LCD Display



Using the Menu System

Task	Description
Entering Menu	When in the OFF mode, press the enter button to bring up the menu.
Navigating Menu	Once in the menu, use the up and down arrows to navigate. Pressing enter will move you into that menu.
Change a Setting	Scroll to the desired value and press enter to select. A check mark should appear beside that item. Press enter again to save the setting and return to the previous screen.
Scroll Parameters	When in Auto or Running mode, pressing the up and down arrows will scroll through the parameter pages.
Lock Screen	When in Auto or Running mode, the screen can be locked to a certain parameter page by pressing enter and unlocked by pressing enter again.
Events History	Once in the menu, select Events History to view the most recent controller event. Use the up and down arrows to navigate to other events. The controller can store up to 150 events. If more than 150 events occur, the oldest event is deleted to make room for the next event.

Front Panel Items

Item	Name	Description
	Off Button	Used for turning off the engine or exiting out of Auto mode. This is not intended to function as an Emergency Stop as there are conditions in which it will not shut down the engine. See the OFF Button Function section for more information.
	Auto Button	Used for placing the controller into AUTO mode. Once in AUTO mode, the controller waits for a start command to be received.
	Run Button	Used to start the engine manually. The Off button must be used to shut down the engine if it has been started using the front panel.
	Up Button	Used for moving around in the menu, changing a setting's value, or changing the currently displayed parameter page.
	Enter Button	Used for entering the menu system, accepting settings, or locking the LCD screen when viewing parameters.
	Down Button	Used for moving around in the menu, changing a setting's value, or changing the currently displayed parameter page.
	Generator LED	Green = Engine running with no issues Amber = Engine running with warnings Red = Engine shut down on failure

3.1 Modes, Starting and Stopping

The following table describes the different operating modes of the controller:

Modes

Mode / State	Description
OFF	When in the OFF mode, the engine cannot be remotely started.
Auto	When in the Auto mode, the engine waits to receive a start command.
Running	When engine is Running, the controller monitors engine parameters and waits to receive a stop command.
Failure	When a failure occurs, the controller shuts down the engine and displays the reason for failure. The unit must be reset using the front panel OFF button with the exception of Modbus.

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Mode / State	Description
Menu	When in the menu mode, settings can be changed and the events history may be viewed.

The following table describes the different methods for starting a controller. Unless using the Manual Run method to start the controller, the controller must be in AUTO mode.

Starting Methods

Methods	Description
Manual Run	Pressing the Run button will start the engine. You must press the OFF button to shut down the engine.
Start / Stop Switched Input	When this input is active the engine will start. When the input becomes inactive the engine will shut down.
Momentary Switched Inputs	Switched inputs Momentary Start and Momentary Stop can be used for starting and stopping of the engine. Unlike other inputs, they only have to be activated for a short period of time.
Battery Recharge	When the battery voltage drops below a certain level the engine will start and run for a predetermined amount of time.
Exerciser	When the scheduled exerciser interval occurs the engine will start and run for a predetermined amount of time.
Auxiliary Sensors	When a properly configured Auxiliary sensor falls below / rises above a certain point the engine will start as determined by the Auxiliary Sensors -> Mode Select settings.
Loss of Mains (TG350AMF only)	When loss of mains power is detected the engine will start to provide power to the load. All the appropriate settings in regards to Auto Mains Failure must be set properly.
Modbus Start (TG410 only)	When a certain command is sent to the controller over Modbus the engine will start. See the Modbus Reference Manual for more information.
J1939 Start	Start/stop command send over the J1939 CANbus. For example from the TR100 or a remote telemetry device.

⚠ **WARNING**: See the Using Cooldown Mode section for more information on how it affects starting and stopping.

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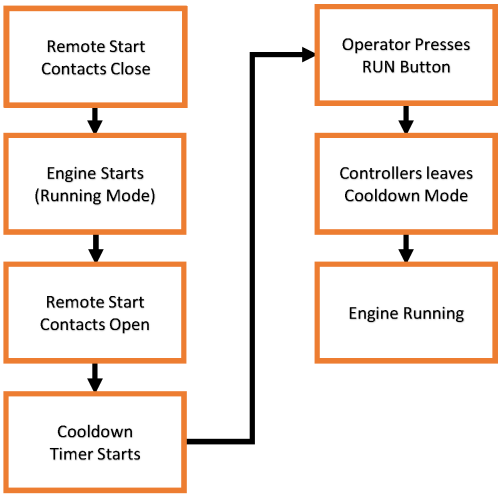
3.2 Using Cooldown Mode

When the controller is configured to have a cooldown period (See Engine Logic section) for the engine, there is some special functionality that must be considered.

The cooldown period is special in that during this time, it will accept a Start Command. This means if the engine is cooling down and a start command is received, the controller will be placed back into a running mode and will not shut down.

Example: The following is an example of how the cooldown functionality works.

1. Remote Start contacts close
2. Engine starts and is in the running mode
3. Remote Start contacts open
4. Engine starts cooldown period
5. User presses RUN button on the front panel
6. Engine moves back into running mode and does not shut down
7. Engine can now only be shut down by using the OFF button or Emergency Stop input



3.3 Failures

Failures are conditions that cause the controller to shutdown to prevent damage to the engine or generator. These get enabled/disabled when you enable/disable various settings in the controller.

Notable failures are given in the below table.

Failure Name	Enabled Condition(s)	Description
ECM Communication Failure	Enabled if loss of ECM communication is enabled. See CAN Bus (J1939).	If the controller has not received messages from the ECM for 6s.
Failure To Stop	Disabled when ETS On Duration is set to 0 seconds. Otherwise it is enabled. ETS should be set to at least 2 to 3s otherwise this failure may not occur.	After ETS countdown is finished if the speed was greater than 50RPM for the previous 2s then the controller triggers this failure.
Load Imbalance	See Load Imbalance.	Generator load imbalance. Excessive AC current on one or more of the three phases.

4 Settings

The following section relates to settings that can be changed to alter the way the controller performs its functions. Read and review these sections carefully to ensure your settings are set correctly for your engine.

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4.1 Operator Setup

The following settings are used to change the way the user interacts with the controller. They are not password protected and can be changed by anyone from the front panel.

Name	Range	Description
Lamp Test	Function	Performs a lamp test on the LEDs when selected.
Display -> LCD Reverse	Function	Reverses the white and black pixels when selected.
Display -> LCD Contrast	5 ~ 95%	Changes the contrast of the LCD.
Display -> Page Scroll	1 ~ 10 seconds	Amount of time between each auto scroll of the parameter pages.
Display -> Message Pop-Up	1 ~ 10 seconds	Amount of time each message is displayed on the screen before displaying next message in the buffer.
Display -> DPF/DEF Display Time	0 ~ 10 seconds	See the J1939 Reference Manual for more information.
Display -> LCD Backlight Timeout	10 ~ 600 seconds	Amount of time the LCD Backlight stays on after button activity stops.
Date / Time -> Date Change	1 ~ 31 days 1 ~ 12 months 2000 ~ 2099 years	Sets the date.
Date / Time -> Time Change	0 ~ 23 hours 0 ~ 59 minutes 0 ~ 59 seconds	Sets the time.
Date / Time -> Daylight Savings	Enable ~ Disable	Turns Daylight Savings Time on or off.
Units -> Temperature Unit	°F or °C	Selects the temperature display format.
Units -> Pressure Unit	PSI or kPa	Selects the oil pressure display format.
Run from OFF	Enable ~ Disable	When enabled, allows a user to start the engine using the run button while in the OFF mode. When disabled the controller must be placed in AUTO mode before the run button can start the engine.

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4.2 Switched Inputs

The controller has switched inputs which cause the controller to perform a function when activated.

Settings

Name	Range	Description
Functions	List - See Below	The function that the switched input performs when active.
Active Modes	List - See Below	Determines the operating conditions under which the switched input can be active. Multiple selections are allowed.
Trigger	List - See Below	The state of the input determining if it is active or inactive.

Functions

Name	Active Mode	Description
Disabled	N/A	Input is disabled and has no function.
Start / Stop	Auto, Running	Starts the engine when active, stops the engine when deactivated. It is recommended to set the Trigger mode to Close +BAT for better noise tolerance. **WARNING:** The Triggers are different from the regular triggers for this function. See the Start / Stop (Momentary Function) section for more information.
Emergency Stop	Global	Shuts down the engine when active and displays 'Emergency Stop.'
Idle Mode	Running	Controller ignores under speed, voltage and frequency warnings and failures when active. If using J1939, the controller will broadcast TSC1 as the Idle Speed parameter found in the Engine Speed section.
Voltage Select 1	Auto	Used for changing the systems voltage configuration. See Voltage Select for more information.
Voltage Select 2	Auto	Used for changing the systems voltage configuration. See Voltage Select for more information.
Battery Charger Fault	Global	Controller displays 'Charger Fault' warning when active.
Momentary Start	Auto	Starts the engine when momentarily active (Approximately 2 seconds).
Momentary Stop	Running	Stops the engine when momentarily active (Approximately 2 seconds).
Configurable Warning 1	Configurable	Controller displays a warning with configurable text* when active.
Configurable Warning 2	Configurable	Controller displays a warning with configurable text* when active.
Configurable Failure 1	Configurable	Controller displays a warning with configurable text* and shuts down engine when active.
Configurable Failure 2	Configurable	Controller displays a warning with configurable text* and shuts down engine when active.
Configurable Failure 3	Configurable	Controller displays a warning with configurable text* and shuts down engine when active.
Air Pressure Failure	Cranking	Controller displays 'Air Pressure Failure' and shuts down engine when active.
Hydraulic Pressure Failure	Cranking	Controller displays 'Hydraulic Pressure Failure' and shuts down engine when active.
Low Oil Pressure Warning	Running	Controller displays 'Oil Pressure Warning' when active.
Low Coolant Level Failure	Global	Controller displays 'Coolant Level Failure' and shuts down engine when active.
High Fuel Warning	Global	Controller displays 'High Fuel Level' warning when active.
Lamp Test	Global	Controller performs lamp test when active.
Fuel In Basin	Global	Controller displays 'Fuel In Basin' warning when active.
Battle Mode	Running	Controller ignores all warnings and failures when active. If a failure occurs during Battle Mode it is 'latched' and the engine will shutdown on failure when the controller leaves Battle Mode.
Start Inhibit	Auto	Controller ignores all start commands and the engine cannot start when active. Once Start Inhibit becomes inactive, starting is enabled again. If the engine is running, activating this input will shut down the engine.

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Name	Active Mode	Description
Primary RPM / 60Hz - Secondary RPM / 50Hz Select	Auto	Used for changing between Primary and Secondary RPM for an engine or 50Hz / 60Hz for a generator. See RPM / Frequency Select for more information.
Preheat Signal	Cranking	When the Preheat Mode setting in the Engine Logic menu is set to Switched Input, it uses this input to determine to control the preheat time.
Remote Reset	Global	Allows the controller to be reset from a failure mode. Momentary action for 3 - 5s in FAILURE mode will place the controller in OFF mode. Momentary action for 3 - 5s in OFF mode will place the controller in AUTO mode.

*The RapidCore Configuration Software must be used to change the text.

Active Modes

Name	Description
Disable	Input cannot be triggered.
Global	Input can be triggered at any time.
OFF Mode	Input can be triggered while in the OFF mode.
AUTO Mode	Input can be triggered while in the AUTO mode.
Running	Input can be triggered after a start command is received until shut down (cooldown not included).
Cranking	Input can be triggered during cranking.
After Cranking	Input can be triggered after engine has started until shut down.
Cooldown	Input can be triggered while cooldown timer is active.

NOTE: More than one Active Mode can be selected.

Triggers

Name	Description
Close +BAT	Input is active when +Battery is present at the terminal.
Close GND	Input is active when Ground is present at the terminal
Close +BAT/GND	Input is active when either +Battery or Ground is present at the terminal.
Open	Input is active when neither +Battery or Ground is present at the terminal.

NOTE: When running wires over long distances (over 20ft / 6.1m), it is recommended to use +BATTERY as the trigger method.

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4.2.1 Voltage Select

The controller has the ability to automatically change its AC voltage display mode and its associated warnings and failures through use of switched inputs. The AC Metering -> Generator Voltage -> Voltage Configuration setting **must** be set to Auto Selection. When using voltage select, the controller will continue to monitor the inputs for 10 seconds after crank success. Once that time expires, the controller will then display the selected voltage configuration.

The table below shows the correspondence between the switched inputs status and the voltage configuration.

Volt Select 1 Input	Volt Select 2 Input	Voltage Configuration
Inactive	Inactive	3-Wire Single Phase
Active	Inactive	3-Phase (1)
Inactive	Active	3-Phase (2)
Active	Active	3-Phase (3)

NOTE: Both Voltage Select 1 and Voltage Select 2 must be assigned to switched inputs for the feature to function properly.

The following settings are affected by the Voltage Select Inputs:

1. AC Monitor -> Generator Voltage -> Auto Nominal
2. AC Monitor -> Generator Voltage -> Auto Scaling Factor
3. AC Monitor -> Generator Current -> Auto Rated Amps
4. AC Monitor -> Generator Current -> Auto Scaling Factor

4.2.2 RPM / Frequency Select

The controller has the ability to change between Primary RPM / 60Hz and Secondary RPM / 50Hz through the use of a switched input. The AC Metering -> Generator Frequency -> Frequency Source setting must be set to RPM Switch for this feature to work. This setting can only be changed when the controller is not in running mode.

The following settings must be set in order for this feature to function:

- Switched Input X -> Primary RPM / 60Hz - Secondary RPM / 50Hz Select
- AC Metering -> Generator Frequency -> Frequency Source -> RPM Switch
- Sensors -> Engine Speed -> Auto RPM Nominal -> Primary RPM / 60Hz
- Sensors -> Engine Speed -> Auto RPM Nominal -> Secondary RPM / 50Hz

The table below shows the correspondence between the switched input status and the RPM / Frequency.

Switched Input	Frequency
Inactive	Primary RPM / 60Hz
Active	Secondary RPM / 50Hz

NOTE: If enabled, the TSC1 PGN will be broadcasted according to the selected speed. Otherwise only the warning and failure setpoints are affected by this function.

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4.2.3 Configurable Inputs

These inputs are used to create custom warnings and failures. Using the DYNAGEN Configurator you can change the text displayed when the warning or failure occurs. If you select one of these inputs without changing the text it will default to 'Config Warn X' and 'Config Fail X.'

There are also timers associated with the configurable inputs which can be found in the menu under *Timers -> Trigger Delays*. These timers change the amount of time the input has to be active before the controller registers the warning or failure.

⚠ **NOTE**: If the switched input becomes inactive before the trigger delay time expires, the warning or failure will not occur.

Example: The user wants a pump to turn on 30 seconds after a high water level switch is tripped and remain on until the level switch turns off.

The level switch is connected to Switched Input C and closes to ground when the water level is too high. The words 'Water Pumping' are also required to be displayed on the controllers LCD screen. The pump is connected to a slave relay which is controlled by Switched Output D on the controller.

Relevant Settings

Setting	Value
Switched Input C -> Function	Configurable Warning 1
Switched Input C -> Active Mode	Global
Switched Input C -> Trigger	Close GND
Configurable Warning 1 Custom Text	Water Pumping
Switched Output D -> Warnings	Configurable Warning 1

4.2.4 Start / Stop (Momentary Function)

When a switched input is configured to **Start / Stop**, the trigger modes have different meanings than other inputs. The following table describes the trigger mode functionality.

Trigger	Description
Close to +Battery	Input active when +Battery is applied.
Close to Ground	Input active when ground is applied.
Close to +Battery / Ground	Input active when +Battery or ground is applied for approximately 2 seconds then deactivated.
Open	Input active when neither +Battery or ground is applied for approximately 2 seconds then deactivated.

The reason for changing these trigger modes is to allow the user to wire a single push button to be used for both starting and stopping the engine. Holding the button for too long will cause the engine to shut down immediately after starting and vice versa.

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4.2.5 Idle Inhibit

Use this feature to prevent start up while in Idle mode.

Name	Range	Description
Start / Stop Switched Input Inhibit	Enable ~ Disable	Prevent the remote start switch input from starting the engine when the idle switch is active.
Aux 1,2,3,4 Sensor Autostart Inhibit	Enable ~ Disable	Prevent Auxiliary 1, 2, 3, and 4 sensors autostart feature from starting the engine when the idle switch is active.

If the engine is in the IDLE mode because of the automatic idle feature, the remote start (start/stop) and auxiliary sensors autostart can still start the engine.

4.3 Switched Outputs

The controller has switched outputs that are turned on under certain conditions to perform a function. The outputs turn on to +Battery voltage to drive the load when active. The following items are the available functions for switched outputs.

WARNING: Switched outputs have a floating voltage of approximately 8V when off. If using the outputs for digital logic, it will be necessary to put a pull-down resistor (1k□) from the output to ground to ensure a low logic level when output is off.

Event Functions

Name	Active Mode	Description
Pull Coil	Cranking	See Pull and Hold Coil section for more information.
LCD Backlight	Global	Active when LCD Backlight is active.
Voltage Regulator	Running	Active when engine is starting/running and is not in Idle Mode.
Energize to Stop	ETS Timer	Active during Energize to Stop timer.
Fuel	Cranking, Running	Active during cranking and running to supply fuel to engine.
Crank	Cranking	Active during cranking to start the engine.
Glowplug	Preheat, Midheat, Postheat	Active during the Preheat, Midheat and Postheat timers.
Not In Auto	Off	Active when the controller is in the OFF mode.
Idle Mode	Idle Mode	Active when Idle Mode switched input is active.
Warmup	Warmup Timer	Active after Warmup timer has expired to apply load to engine.
Cooldown	Cooldown Timer	Active when Cooldown timer is active.
Engine Running	Cranking, Running	Active when engine is cranking or running.
Exercising	Exercise Timer	Active during the engine exercising cycle.
Battery Recharge	Battery Recharge Timer	Active during the battery recharge cycle.
Maintenance Required	Global	Active when Maintenance timer has expired.
Low Battery During Cranking	Cranking	Active when Low Battery During Cranking warning is displayed.
Auxiliary Sensor 1	Auxiliary Settings Dependent	Active dependent upon settings in the Auxiliary sensor section.
Auxiliary Sensor 2	Auxiliary Settings Dependent	Active dependent upon settings in the Auxiliary sensor section.
Auxiliary Sensor 3	Auxiliary Settings Dependent	Active dependent upon settings in the Auxiliary sensor section.
Auxiliary Sensor 4	Auxiliary Settings Dependent	Active dependent upon settings in the Auxiliary sensor section.
System Ready	Auto	Active when controller is in Auto mode and no warnings or failures are present.
Delay to Start	Delay to Start Timer	Active when the Delay to Start timer is active.
Battle Mode	Battle Mode	Active when Battle Mode switched input is active.
Force Regeneration	User Controlled	When user triggers a Force Regeneration, output is active for 20 seconds then switches off.

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Name	Active Mode	Description
Regeneration Inhibit	User Controlled	When user triggers a Regeneration Inhibit, output is active for 20 seconds then switches off.
Common Failure	Any Failure	Active when any failure occurs.
RPM Increment	Running	Output is used to to trigger inputs on an ECM to control speed. See Front Panel Speed Control section for more information.
RPM Decrement	Running	Output is used to to trigger inputs on an ECM to control speed. See Front Panel Speed Control section for more information.
DEF Fluid Level	Running	Active when DEF Fluid Level falls below the DEF Low Level and stays active until the level rises above the DEF High Level. See CAN Bus (J1939) section for more information.
Genset Disable	Global	Disables the generator during a stationary Regen on Kubota engines (see Aftertreatment in the J1939 User Manual) or also during an engine IDLE condition from the IDLE switched input. Automatic idle is ignored. If the generator voltage is not below the under voltage setpoint in 10s, the controller will shut down the engine on "Generator Disable Failure."
Dummy Load	Running	Output is controlled by the dummy load feature.
Breaker Trip	Running	Output is controlled by the Over Current Failure or IDMT features and by the Load Imbalance feature.

Warning Functions

Functions			
Low Engine Temperature	High Engine Temperature	Low Oil Pressure	Under Speed
Over Speed	Low Fuel Level	High Fuel Level	Low Battery Voltage
High Battery Voltage	Under Frequency	Over Frequency	AC Under Voltage
AC Over Voltage	Over Current	Fuel In Basin	Battery Charger Fault
Configurable Warning 1	Configurable Warning 2	Auxiliary Sensor 1	Auxiliary Sensor 2
Auxiliary Sensor 3	Auxiliary Sensor 4	Load Imbalance (More Information)	DTC Received. Active when controller receives a DM1 from the ECM.

Failure Functions

Functions			
Overcrank	Engine Failed to Stop	DM1 Stop Lamp	High Engine Temperature
Low Oil Pressure	Low Fuel Level	Under Speed	Over Speed
Low Battery Voltage	High Battery Voltage	Low Coolant Level	Low Air Pressure
Low Hydraulic Pressure	Under Frequency	Over Frequency	AC Under Voltage
AC Over Voltage	Over Current (TG410 only)	ECM Communication Failure	Configurable Failure 1
Configurable Failure 2	Config Fail 3	Auxiliary Sensor 1	Auxiliary Sensor 2
Auxiliary Sensor 3	Auxiliary Sensor 4	Load Imbalance (More Information)	---

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4.3.1 Group Outputs

Group functions have been designed to allow multiple output functions to be bundled together and assigned to a single switched output pin. The definition of a group output follows:

When any of the functions in a group is active (OR logic), the assigned switched output will be active.

Group Functions

Name	Active Mode	Description
Group #1	Group Dependent	Must be set from DYNAGEN Configurator software.
Group #2	Group Dependent	Must be set from DYNAGEN Configurator software.
Group #3	Group Dependent	Must be set from DYNAGEN Configurator software.
Group #4	Group Dependent	Must be set from DYNAGEN Configurator software.

Example: Low AC Frequency, High AC Frequency are bundled in 'Group #1' and assigned to Switched Output D. This output is connected to an external indicator lamp labeled 'AC Frequency Warnings', allowing one output to indicate there is a warning with the AC frequency. The following table shows the output state based on the warnings status.

Low AC Frequency Warning	High AC Frequency Warning	Switched Output State
Inactive	Inactive	OFF
Inactive	Active	ON
Active	Inactive	ON
Active	Active	ON

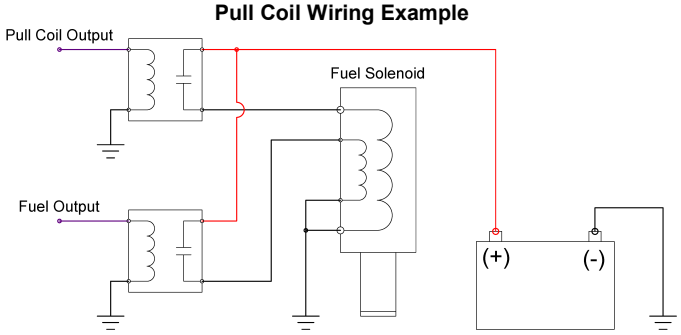
4.3.2 Pull and Hold Coil

On some engine systems the fuel pump has two coils. This is because the initial power on of the fuel solenoid requires substantial current (Pull Coil), but only needs a small amount of current to hold it in place (Hold Coil).

1. Hold Coil (Fuel) is energized.
2. Pull Coil is energized for 2 seconds before cranking.
3. Repeat if engine cranking failed.

Configuring a switched output to Pull Coil automatically configures the engine logic necessary for a Pull Coil system.

Pull Coil Wiring Example



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4.4 Sensors

The controller has sensor ports which can be connected to a variety of different sensor types (Temperature, Pressure, Level, etc). See the Terminal Descriptions section for more information regarding terminal / sensor compatibility (Low Ohm, High Ohm, 0-5V or 4-20mA).

Most sensors are used to monitor for warnings and failures but the Auxiliary sensors can be used to perform special functions (Example: Starting engine on low temperature).

4.4.1 Engine Temperature

Use the following settings' configurations to allow the controller to read and interpret data from the engine temperature sensor.

Name	Range	Description
Signal Source	Sensor Port X J1939 Bus	The source from which the sensor data is attained.
Sensor Type	DAT DAH* VDO 250F* (custom sender)** Close = Warning Open = Warning Close = Failure Open = Failure	DAT DAH supports all Datcon type DAH (high range) temperature sensors. VDO 250F supports the VDO 323-420 or equivalent temperature sensor. *Note: DAT DAH and VDO 250F can only be used if the Signal Source is set to Port A, C, or D. If using a switch it must close to ground. It can be normally open or normally closed. "Open" means open circuit. **A custom table can also be created using the RapidCore Configuration Software. (custom sender) will be replaced with the custom text you choose.
Trim Offset	-50.0 ~ 50.0°F (-10 ~ 10^{0}C)	Calibrate a sensor by using the offset to correct errors.
Setpoints -> Bypass Time	0 ~ 90 seconds	Amount of time to bypass warnings and failures after engine has started.
Setpoints -> Low Warning	32 ~ 200°F (0 ~ 93.3^{0}C)	Reading at which a warning occurs.
Setpoints -> High Warning	50 ~ 300°F (10 ~ 148.9^{0}C)	Reading at which a warning occurs.
Setpoints -> High Failure	50 ~ 300°F (10 ~ 148.9^{0}C)	Reading at which a failure occurs.

Note: All temperature settings are entered in terms of Fahrenheit.

4.4.2 Oil Pressure

Use the following settings' configurations to allow the controller to read and interpret data from the oil pressure sensor.

Name	Range	Description
Signal Source	Sensor Port X J1939 Bus	The source from which the sensor data is attained.
Sensor Type	Sensor Table X Close = Warning Open = Warning Close = Failure Open = Failure	Select one of the pre-configured sensor tables or one of the switch functions. A custom table can also be created using the RapidCore Configuration Software. Close = Ground Open = Open Circuit
Trim Offset	-50.0 ~ 50.0 psi (-344.7 ~ 344.7kPa)	Calibrate a sensor by using the offset to correct errors.
Setpoints -> Bypass Time	0 ~ 90 seconds	Amount of time to bypass warnings and failures after engine has started.
Setpoints -> Low Warning	0.1 ~ 99.0 psi (0.7 ~ 682.6kPa)	Reading at which a warning occurs.
Setpoints -> Low Failure	0.1 ~ 99.0 psi (0.7 ~	Reading at which a failure occurs.

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Name	Range	Description
	682.6kPa)	

Note: All pressure settings are entered in terms of psi.

4.4.3 Fuel Level

Use the following settings' configurations to allow the controller to read and interpret data from the fuel level sensor.

Name	Range	Description
Signal Source	Sensor Port X	The source from which the sensor data is attained.
Sensor Type	Sensor Table X Close = Warning Open = Warning Close = Failure Open = Failure	Select one of the pre-configured sensor tables or one of the switch functions. A custom table can also be created using the RapidCore Configuration Software. Close = Ground Open = Open Circuit
Trim Offset	-50.0 ~ 50.0%	Calibrate a sensor by using the offset to correct errors.
Setpoints -> Bypass Time	0 ~ 90 seconds	Amount of time to bypass warnings and failures after engine has started.
Setpoints -> Low Warning	1 ~ 90%	Reading at which a warning occurs.
Setpoints -> Low Failure	1 ~ 90%	Reading at which a failure occurs.
Setpoints -> High Warning	1 ~ 125%	Reading at which a warning occurs.

4.4.4 Engine Speed

Use the following settings' configurations to allow the controller to read and interpret speed sensing data.

Name	Range	Description
Signal Source	J1939 Bus Mag Pickup Genset Voltage	The source from which the sensor data is attained.
Speed Settings -> Rated RPM	500 ~ 4000	Speed at which the engine runs under normal operating conditions. Warning and failure setpoints are calculated from this setting.
Speed Settings -> Idle RPM	300 ~ 2000	Speed at which the engine runs when it is idling.
Speed Settings -> Tooth Count	1 ~ 600	Number of teeth on the flywheel (Mag Pickup only).
Setpoints -> Low Warning	50 ~ 99%	Reading at which a warning occurs.
Setpoints -> Low Failure	50 ~ 99%	Reading at which a failure occurs.
Setpoints -> High Warning	101 ~ 150%	Reading at which a warning occurs.
Setpoints -> High Failure	101 ~ 150%	Reading at which a failure occurs.
Front Panel Speed Control Settings	N/A	See Front Panel Speed Control section for more information on these settings.
RPM Switch -> Secondary RPM / 50Hz	500 ~ 4000	The Rated RPM when the Secondary RPM / 50Hz is selected. See RPM / Frequency Select section for more information.
RPM Switch -> Primary RPM / 60Hz	500 ~ 4000	The Rated RPM when the Primary RPM / 60Hz is selected. See RPM / Frequency Select section for more information.

NOTE: When using J1939 or Genset Signal as a signal source, connections to the speed sensing terminals are not required.

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4.4.4.1 Front Panel Speed Control

The operator is able to adjust the speed of the engine by using the controller's front panel. This section describes the two methods available for implementing speed control, the settings and parameters to be used, as well as the necessary instructions allowing the operator to control the speed.

Speed Control Methods

Setting	Description
J1939 (TSC1 Speed Command)	The controller can instruct the ECM of an electronic engine to adjust its speed by broadcasting the TSC1 command.
Switched Outputs	The controller can instruct the ECM of an electronic engine to adjust its speed by using switched outputs on the controller set to RPM Increment and RPM Decrement to interface with digital inputs on the ECM. When the speed is changed, the corresponding switched output will be on for 1 second each time increment or decrement is pressed.

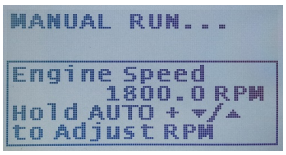
⚠ **WARNING**: Switched outputs have a floating voltage of approximately 8V when off. If using the outputs for digital logic, it will be necessary to put a pull-down resistor (1kOhm, 1 Watt) from the output to ground to ensure a low logic level when output is off.

Speed Control Settings

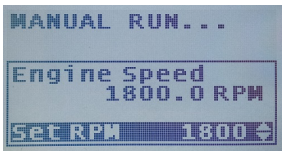
Name	Range	Description
Speed Control Enable	Enable ~ Disable	Enables or disables front panel speed control.
RPM Display	Nothing / Blank AC Frequency Auxiliary Sensor 1 Auxiliary Sensor 2	Parameter to display when adjusting speed from front panel. This is used to provide operator feedback in cases where the engine RPM affects another parameter such as AC Frequency or an Auxiliary Sensor (Example: Flow rate of pump).
RPM Control -> Limit Method	Speed Bias Min RPM / Max RPM	This regulates the minimum / maximum speeds within which the operator may make adjustments.
RPM Control -> Speed Bias	0 ~ 600	The minimum / maximum RPM the engine speed may be adjusted, based on the Rated RPM. Example: Rated RPM is 1800 and Speed Bias is 150. The minimum RPM will be 1650 and maximum RPM will be 1950. Only valid when the correct limit method is chosen.
RPM Control -> Minimum RPM	500 ~ 4000	The minimum RPM that can be set using speed control. Only valid when the correct Limit Method is chosen.
RPM Control -> Maximum RPM	500 ~ 4000	The maximum RPM that can be set using speed control. Only valid when the correct Limit Method is chosen.

Speed Control Instructions

When the controller is running and there are other functions occurring, the controller will scroll through its display parameters as usual. When the speed control page is displayed, it will show the Engine Speed as well as the following instructions: Hold AUTO + Up/Down to Adjust RPM.



Speed Control Parameter Page



Speed Control Adjust Page

Pressing and holding the AUTO button will display the screen to the right. If a 'Display Adjust Parameter' is set, it will also be displayed underneath the Engine Speed. While still holding the AUTO key, press the up or down arrows to adjust the RPM. The Engine Speed display should update as the engine physically changes its speed to accommodate the speed request.

⚠ **NOTE**: When using switched outputs for speed control, the Set RPM will display '---' instead of the set speed.

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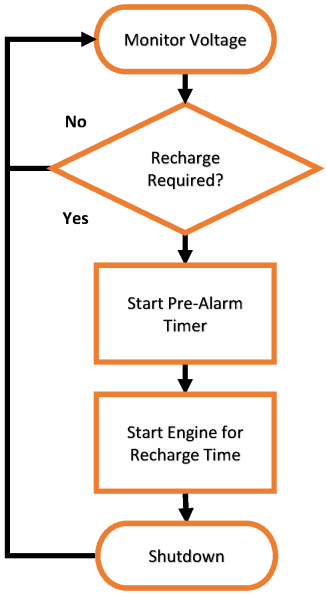
4.4.5 Battery Level

Use the following settings' configurations to allow the controller to read and interpret the battery voltage level.

Name	Range	Description
Battery Recharge	Enable ~ Disable	Enables or disables the ability to have the engine start on low battery voltage in order to charge it.
Recharge Setup -> Level	6.0 - 30.0V	Voltage level at which the controller starts the engine to recharge the battery.
Recharge Setup -> Pre-Alarm	1 ~ 30 minutes	Amount of time to display a warning before starting the engine.
Recharge Setup -> Duration	10 ~ 900 minutes	Amount of time to run the engine.
Setpoints -> Low Warning	6.0 ~ 24.0V	Reading at which a warning occurs.
Setpoints -> Low Failure	6.0 ~ 24.0V	Reading at which a failure occurs.
Setpoints -> High Warning	12.0 ~ 32.0V	Reading at which a warning occurs.
Setpoints -> High Failure	12.0 ~ 32.0V	Reading at which a failure occurs.
Crank Low Batt	6.0 ~ 24.0V	Screen displays a 'Low Voltage During Cranking' warning if voltage dips below this level during cranking.

NOTE: When the engine is running, the battery voltage will equal the alternator charging voltage. The actual open-circuit battery voltage may be lower than displayed.

Battery Recharge Sequence



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4.4.6 Auxiliary

The Auxiliary sensors on the controller are used for performing functions based on sensor readings. There are two different ways the auxiliary sensors may be utilized:

Scenario #1 - Custom Sensors
Use the auxiliary sensors to create custom sensors (Current, Voltage, etc.) that are not supported by the controller by default (engine temperature, oil pressure, fuel level).

Scenario #2 - Add-On Functionality
Double up the auxiliary sensor onto the same Sensor Port that is currently being used by one of the other sensors (engine temperature, oil pressure, fuel level). This allows you to use the special functions (Start on Low, Output on High, etc.) in conjunction with those sensors.

NOTE: You must set the auxiliary sensor port and sensor table to the same values as the other sensor.

Name	Range	Description
Signal Source	Sensor Port X	The source from which the sensor data is attained.
Display	Enable ~ Disable	Determines if the sensor's value is displayed on the screen when the engine is running.
Active Mode	Disable Global Not In Auto Auto State Running Cranking After Cranking Cooldown	Determines under which operating conditions the Auxiliary Sensor is monitored. Multiple selections are allowed. Does not apply to "Start on Low" or "Start on High"; for those selections the active mode is always "Not In Auto". Refer to the examples in the following pages for information on specific mode functions.
Func. Select	Fault Monitor Output on Low Output on High Start on Low Start on High	Determines how the controller responds to the readings of the auxiliary sensor Refer to the examples in the following pages for more information on specific mode functions.
Trim Offset	-50.0 ~ 50.0 units	Calibrate a sensor by using the offset to correct errors.
Mode Settings -> Bypass Time	0 ~ 90 seconds	The amount of time to ignore the sensor input after the selected active mode is entered. Once triggered the bypass time does not apply again until the device resets (for example transitioning from RUN to the OFF or AUTO state) or on power-up.
Mode Settings -> Active Time[1]	1 ~ 600 minutes	The amount of time to turn on the auxiliary switched output or engine before turning off.
Mode Settings -> Start Level[1]	Sensor Table Dependent	The level at which the auxiliary switched output or engine turns on.
Mode Settings -> Stop Level[1]	Sensor Table Dependent	The level at which the auxiliary switched output or engine turns off.
Setpoints -> Low Warning	Sensor Table Dependent	Reading at which a warning occurs.
Setpoints -> Low Failure	Sensor Table Dependent	Reading at which a failure occurs.
Setpoints -> High Warning	Sensor Table Dependent	Reading at which a warning occurs.
Setpoints -> High Failure	Sensor Table Dependent	Reading at which a failure occurs.

[1] Refer to the sections below for more information on how these settings affect the auxiliary sensors.

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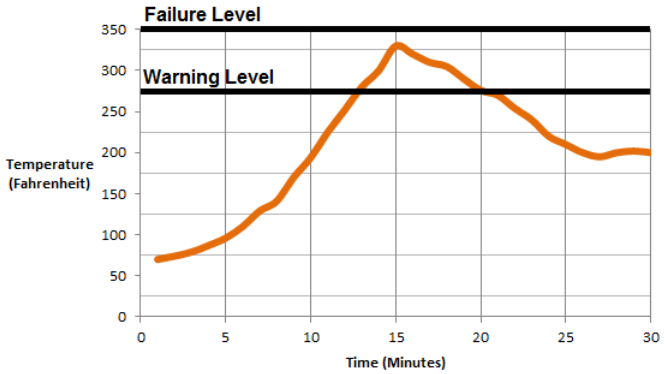
4.4.6.1 Fault Monitor Example

In this example, a sensor is monitoring the temperature of an engine block. If the temperature rises above 275°F, a warning message is displayed. If the temperature rises above 350°F, the engine shuts down and a failure message is displayed.

Relevant Settings

Setting	Value
Signal Source	Same as Engine Temperature
Display	Disable (If enabled, controller will display Engine Temperature twice)
Sensor Type	Same as Engine Temperature
Sensor Table Name	Engine Temp.
Active Range	Running
Mode Select	Fault Monitor
Setpoints -> Low Warning	Disabled
Setpoints -> Low Failure	Disabled
Setpoints -> High Warning	275°F
Setpoints -> High Failure	350°F



The chart above shows the connection between engine temperature and time. At approximately 13 minutes run time, the temperature rises above the 275°F warning threshold, activating the warning display. The engine will continue to run because it has not reached the 350°F failure threshold. At 20 minutes run time, the temperatures falls below the warning threshold and the warning disappears.

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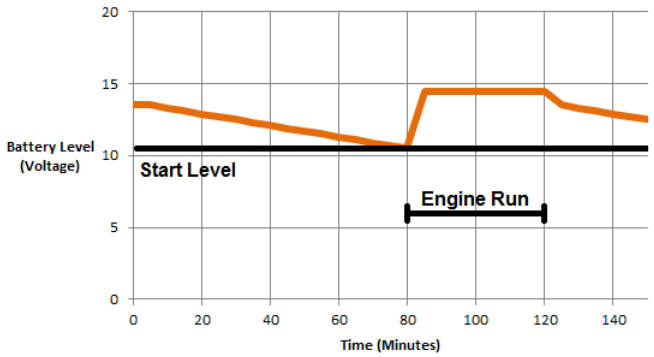
4.4.6.2 Start on Low / High Example

In this example, a sensor is monitoring the voltage of an external battery bank. If the voltage falls below 10.5V, the engine will start and run for 40 minutes to charge the battery.

Relevant Settings

Setting	Value
Signal Source	Sensor Port X
Display	Enable
Sensor Type	Custom
Sensor Table Name	Battery Bank
Active Range	N/A (These ranges are fixed for Start on Low / High)
Mode Select	Start on Low
Mode Settings -> Active Time	40 minutes
Mode Settings -> Start Level	10.5V
Mode Settings -> Stop Level[1]	Disabled

[1] Stop Level needs to be disabled when the engine is running because the battery voltage will equal the alternator charging voltage. Having this disabled will force the engine to run for the entire duration of the active time.



The chart above shows the connection between a battery bank and time. At approximately 80 minutes time, the voltage falls below the 10.5V start threshold causing the engine to start. The engine runs for the 40 minutes active time regardless of the voltage reading and then shuts down.

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4.4.6.3 Output on Low / High Example

In this example, a sensor is monitoring the temperature of an engine. If the temperature rises above 325°F, a fan will turn on to cool the engine. Once the temperature drops to below 200°F the fan will turn off.

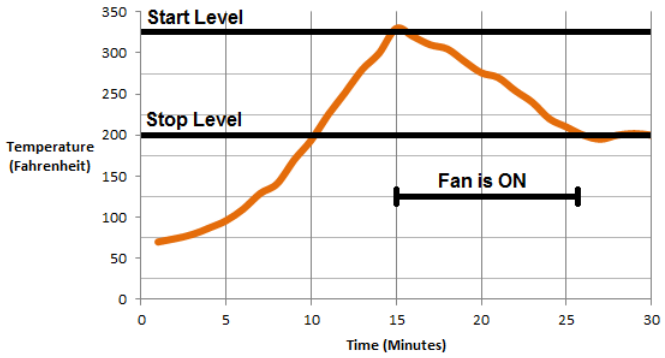
Relevant Settings (Auxiliary Sensor)

Setting	Value
Signal Source	Same as Engine Temperature
Display	Disable (If enabled, controller will display Engine Temperature twice)
Sensor Type	Same as Engine Temperature
Sender Table Name	Engine Temp.
Active Range	Global
Mode Select	Output on High
Mode Settings -> Active Time[1]	Disabled
Mode Settings -> Start Level	325°F
Mode Settings -> Stop Level	200°F

[1] Active time is disabled because the fan needs to stay on indefinitely or until 200°F is reached.

Relevant Settings (Switched Outputs)

Setting	Value
Switched Output X	Auxiliary Sensor X (Choose based on which Auxiliary Sensor is being used)



The chart above shows the connection between engine temperature and time. At approximately 10 minutes run time, the temperature rises above the 325°F start threshold and the fan turns on. The fan continues to run as the temperature declines. When the temperature falls below the 200°F stop threshold, the fan turns off.

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4.4.7 Custom Sensor Tables

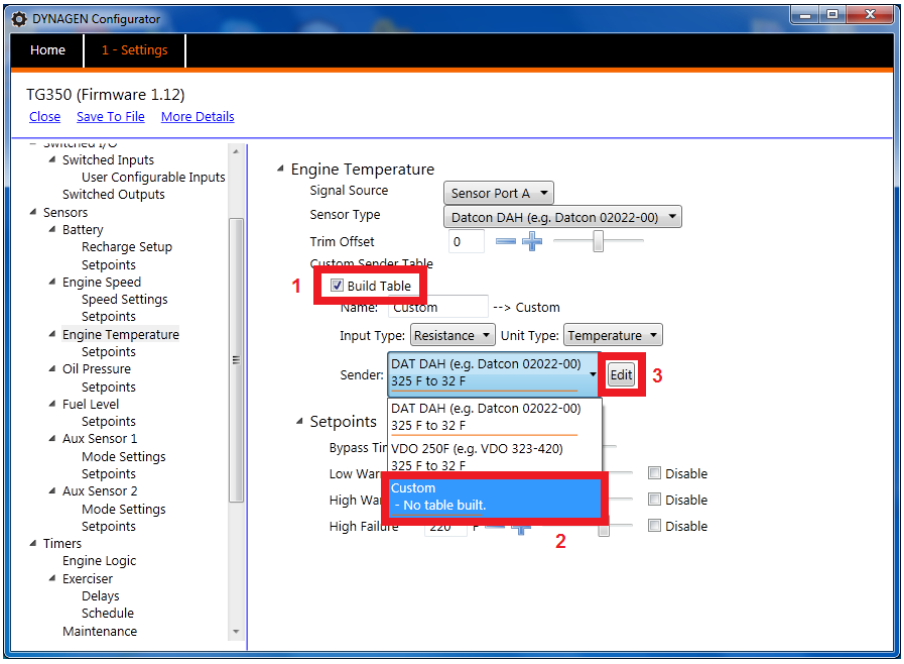
Custom Sensor Tables are created using the RapidCore Configuration Software when using a sensor that is not supported by DYNAGEN. The configurator has the ability to create these custom tables, allowing the controller to properly read the sensor data.

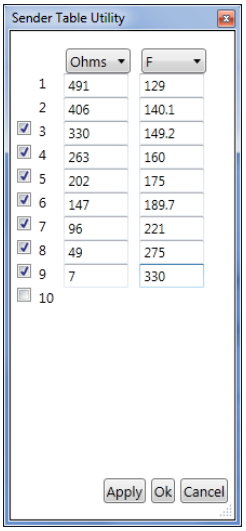
NOTE: Custom sender tables can only be created when using the configuration software.

Parameter	Description
Name	The label that will be displayed in the controller (Engine Temp, Oil Pressure, etc.)
Input Type	Choose resistance, voltage or current based on the sensor type. Use the Terminal Descriptions section to determine if your sensor is compatible with a sensor port.
Unit Type	Choose temperature, pressure, voltage, current or percentage based on the sensor. This defines what unit of measurement will be displayed on the front panel (ºF, psi, V, A, %).

The following example outlines the steps for creating a custom sensor table:

1. Navigate to the sensor input that will be using your custom sensor table.
2. Select a Name, Input Type and Unit Type for the controller (Definitions in table above).
3. Click the check box next to 'Build Table' (Image Step 1).
4. From the 'Sender' drop down menu, select 'Custom' (Image Step 2).
5. Click the 'Edit' button next to the drop down menu (Image Step 3).
6. Enter the sensor values. Once entered, click Apply then OK.





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4.5 Timers

The controller has an internal clock which is used not only to keep time, but to ensure programed events happen at the correct times. The following sections are used to configure settings associated with timing functions.

NOTE: The controller has an on-board backup battery to keep time even when main power is not supplied to the unit. This battery has an unpowered (no main power) lifetime of approximately five years.

4.5.1 Engine Logic

The following settings determine how the controller starts and stops the engine. It gives the user the functionality to add delays and timers to the sequences. Most of the settings have a switched output associated with them that must be set in the Switched Outputs settings.

NOTE: Setting a timer's value to 0 seconds will disable the timer. Example: If Delay to Start is set to 0 seconds, the controller will not perform a Delay to Start when starting the engine.

Name	Range	Description
Delay to Start	0 ~ 90 seconds	Amount of time to delay the starting of the engine after receiving a command to start.
Delay to Start on Manual Run	Enable ~ Disable	Determines if the the Delay to Start timer is used when the front panel RUN button is used to start the engine.
Preheat Mode	Preheat Timer Switched Input J1939	Determines the method used to control enabling the glowplug output. See the Preheat Mode section for more information.
Preheat Time	0 ~ 90 seconds	Amount of time the Glowplug output is active before cranking the engine. Used on diesel engines to warm the engine before cranking.
Crank Time	3 ~ 30 seconds	Amount of time the Crank output is active before going to crank rest. This timer immediately expires upon successful cranking.
Midheat Time	0 ~ 90 seconds	Keeps Glowplug output turned on while cranking but not during crank rest. Output will turn off upon crank failure, crank success or midheat time expiration.
Crank Rest Time	1 ~ 90 seconds	Amount of time to delay between each attempt to start the engine.
Crank Attempts	1 ~ 20	Number of attempts to start the engine before going to an overcrank failure.
Fuel Crank Rest	Fuel ON Fuel OFF	Determines if the fuel output stays on during the crank rest time.
RPM Disconnect	100 ~ 2000 rpm	Speed at which controller determines the engine has started successfully and turns off the Crank output.
Postheat Time	0 ~ 90 seconds	Amount of time the Glowplug output remains on after crank success and the engine is running.
Restart on False Start	Enable ~ Disable	(Only applies to remote start.) Determines if the controller will monitor for false starts and attempt a restart. Controller will only attempt restarting the engine as many times as determined by Crank Attempts.
False Restart Detect Time	5 ~ 30 seconds	(Only applies to remote start.) Amount of time after successful cranking to monitor for a false restart. If this time expires and the engines stalls out, the controller will not attempt a restart.
Auto Idle	Enable ~ Disable	Determines if the controller will automatically enter Idle Mode during the Warmup and Cooldown delays.
Warmup Time	0 ~ 600 seconds	After successful cranking, engine delays this amount of time before turning on the Warmup output. This allows the engine to warm up before applying any load to it. The output will turn off when the controller enters the Cooldown Delay.
OFF Button Function	Cooldown Shutdown Force Cooldown	The function the OFF button on the front panel performs while engine is running. See the OFF Button Function section for more information.
Cooldown Delay	0 ~ 600 seconds	Amount of time to cool down the engine after a stop

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Name	Range	Description
		command has been received. During this time the Warmup output turns off and the Cooldown output turns on. If another start command is received during cool down, the controller will return to running mode.
ETS On Duration (Energize to Stop)	0 ~ 30 seconds	Amount of time the Energize to Stop output is on after the engine has shut down. If controller still detects speed (RPM) after this time expires, it goes to a 'Failed to Stop' failure. Time must be greater than 0 seconds for the Energize to Stop function to work.

4.5.1.1 Preheat Mode

The controller has the ability to control the length of the preheat time through 3 different methods. The table below describes each method:

Mode	Description
Preheat Timer	This mode uses the Preheat Timer setting in the Engine Logic menu.
Switched Input	This mode uses a switched input set to Preheat Signal.
J1939	This mode uses commands sent from the ECM over J1939.

⚠ **NOTE**: During preheat the Glowplug switched output is on.

4.5.1.2 OFF Button Function

The OFF button on the front panel of the controller can be configured to function in 3 different ways while the engine is running. The table below describes each of these functions:

Function	Description
Cooldown	This function causes the controller to go into cooldown. Pressing the OFF button again will cause the engine to shut down.
Shutdown	This function bypasses Cooldown and causes the engine to shut down.
Force Cooldown	This function causes the controller to activate the cooldown process. Pressing the OFF button will have no affect as the controller is forcing the engine to perform a full cool down.

⚠ **WARNING**: If the controller receives a command to start while in Cooldown, it will leave the Cooldown mode and go back to Running mode.

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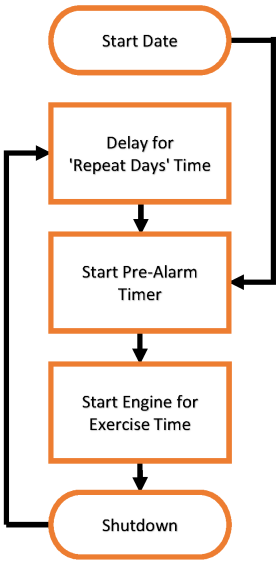
4.5.2 Exerciser

The Exerciser function is used start and run the engine periodically. This is commonly used to ensure issues with the engine do not arise from sitting idle for too long. The following settings configure the Exerciser function:

Name	Range	Description
Enable	Enable ~ Disable	Determines if the engine is automatically exercised periodically.
Delays -> Pre-Alarm	1 ~ 20 minutes	Amount of time to display a warning before starting the engine.
Delays -> Run Time	10 ~ 1500 minutes	Amount of time to run the engine.
Schedule -> Start Date	1 ~ 31	The initial day of the month to run the exerciser.
Schedule -> Start Hour	0 ~ 23	The initial hour of the day to run the exerciser.
Schedule -> Repeat Days	1 ~ 28 days	Number of days between each exerciser cycle.

When configuring the Start Date and Hour, a future time must be selected to run the initial exerciser sequence. After the initial sequence, the exerciser runs at an interval determined by 'Repeat Days.'

Exerciser Sequence



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4.5.3 Maintenance

The controller has the ability to count down the time between scheduled maintenance events. Once maintenance is required, the controller will alert the operator via the LCD screen and a switched output (if enabled) wired to a lamp / horn / buzzer. The following settings are used to configure the maintenance timer.

Name	Range	Description
Reset Counter	Enable ~ Disable	Once the maintenance count interval expires, use this setting to reset the time and turn off the switched output (if enabled).
Enable Counter	Enable ~ Disable	Determines the number of hours between required maintenance. A switched output can be configured to turn on once the count interval expires.
Counter Interval	10 ~ 9990 hours	Enables or disables the maintenance function.

To determine the amount of time until the next scheduled maintenance, follow these menu steps:

Main Menu -> Device Info. -> Maintenance

Maintenance counter is disabled if '----' is displayed. A negative number indicates the amount of time since maintenance timer expired.

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4.6 AC Monitor

The controller has the ability to monitor AC voltage and current from a generator. The following sections are used to configure settings associated with AC monitoring.

4.6.1 Generator Voltage

The following settings are used to configure the controller's response to voltage measurements.

Name	Range	Description
Voltage Source	Disable 2-Wire Single 3-Wire Single 3-Wire 3-Phase 4-Wire 3-Phase 4-Wire Delta Auto Selection	The wiring configuration of the generator. Selecting Auto Selection will use the Voltage Select inputs to determine which wiring configuration is implemented and displayed.
Scaling Factor	0.500 ~ 2.500	Scaling factor at which the voltage is read into the controller. See below for more information.
Nominal Volts	50 ~ 800 VAC*	Voltage at which the generators run when operating under normal running conditions.
Auto Nominal -> 1-Phase 3-Wire	50 ~ 800 VAC*	Nominal Volts when using the Voltage Select inputs. ⚠ ***NOTE**: 800 VAC applies to software logic only. Do not exceed 600 VAC on the AC Voltage terminals.
Auto Nominal -> 3-Phase (1)	50 ~ 800 VAC*	
Auto Nominal -> 3-Phase (2)	50 ~ 800 VAC*	
Auto Nominal -> 3-Phase (3)	50 ~ 800 VAC*	
Auto Ratios -> 1-Phase 3-Wire	0.500 ~ 2.500	Scaling Factor when using the Voltage Select inputs.
Auto Ratios -> 3-Phase (1)	0.500 ~ 2.500	
Auto Ratios -> 3-Phase (2)	0.500 ~ 2.500	
Auto Ratios -> 3-Phase (3)	0.500 ~ 2.500	
Auto Single	A-C Phase A-B Phase	For 1-Phase 3-Wire when using the Voltage Select inputs. This determines which phases the voltage is read from.
V Setpoints -> Low Warning	50 ~ 99%	Reading at which a warning occurs.
V Setpoints -> Low Failure	50 ~ 99%	Reading at which a failure occurs.
V Setpoints -> High Warning	101 ~ 150%	Reading at which a warning occurs.
V Setpoints -> High Failure	101 ~ 150%	Reading at which a failure occurs.

Application Note: Scaling Factor
The scaling factor setting can be used to calibrate the AC voltage if there are discrepancies between the reading and the actual value. It can also be used if transformers are used to step up / down the voltage. The scaling factor applies to all phases in a system.

Example: The voltage source is a 3-Wire 3-Phase system with a nominal voltage of 208 VAC. The controller is reading 206.3 VAC but a calibrated multimeter gives 208.3 VAC. Use the formula below to determine the scaling factor.

1. Scaling Factor = Multimeter Reading / Controller Reading
2. Scaling Factor = 208.4 VAC / 206.3 VAC
3. Scaling Factor = 1.010

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4.6.2 Generator Frequency

The following settings are used to configure the controller's responses to frequency measurements.

Name	Range	Description
Frequency Source	Nominal 50Hz Nominal 60Hz Auto Selection	This is the wiring configuration of the generator. Selecting Auto Selection will use the Frequency Select input to determine which frequency is used.
Hz Setpoints -> Low Warning	50 ~ 99%	Reading at which a warning occurs.
Hz Setpoints -> Low Failure	50 ~ 99%	Reading at which a failure occurs.
Hz Setpoints -> High Warning	101 ~ 150%	Reading at which a warning occurs.
Hz Setpoints -> High Failure	101 ~ 150%	Reading at which a failure occurs.

4.6.3 Generator Current

The following settings are used to configure the controller response to current measurements.

Name	Range	Description
Current Source	Enable ~ Disable	Enables or disables current metering.
Turns Ratio	5 ~ 5000A : 5A	The turns ratio of the current transformers.
Scaling Factor	0.500 ~ 1.250	Scaling factor at which the voltage is read into the controller. See below for more information.
Volt Sel Inputs -> 1-Phase 3-Wire	5 ~ 5000A : 5A	Rated Amps when using the Voltage Select inputs.
Volt Sel Inputs -> 3-Phase (1)	5 ~ 5000A : 5A	
Volt Sel Inputs -> 3-Phase (2)	5 ~ 5000A : 5A	
Volt Sel Inputs -> 3-Phase (3)	5 ~ 5000A : 5A	
Volt Sel Ratios -> 1-Phase 3-Wire	0.500 ~ 2.250	Scaling Factor when using the Voltage Select inputs.
Volt Sel Ratios -> 3-Phase (1)	0.500 ~ 2.250	
Volt Sel Ratios -> 3-Phase (2)	0.500 ~ 2.250	
Volt Sel Ratios -> 3-Phase (3)	0.500 ~ 2.250	
Setpoints -> Rated Amps	5 ~ 5000A	Maximum current draw the generator can provide when operating under normal running conditions.
Setpoints -> High Warning	1 ~ 125%, Disable	See Basic Alarms.
Setpoints -> High Failure	1 ~ 125%, Disable	
Breaker Trip Failure	Enable ~ Disable	Shuts down the generator if the generator circuit breaker fails to trip. If the Breaker Trip switched output is active - due to IDMT or Load Imbalance - and if after 10s the measured generator current is still above 10% of the Rated Current the generator will shut down.
IDMT Mode	Disable; Breaker Trip Shutdown Trip	See IDMT for more information.
TDS (Time Dial Setting)	0.1 ~ 30	
Reset Time	1 to 600s	
Load Imbalance Mode	Disable Breaker Trip Shutdown Trip	See Load Imbalance for more information.
Load Imbalance %	1 ~ 200%	
Load Imbalance Delay	1 ~ 600s	
Bypass	Disabled, 1 ~ 120s	See Dummy Load for more information.
Load On	Disabled, 1 ~ 500A	
Load Off	Disabled, 1 ~ 500A	

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4.6.3.1 Basic Alarms

The controller can give a warning and/or shutdown on over current. If IDMT is enabled then it overrides the High Failure shutdown but the warning is still active.

Name	Range	Description
Setpoints -> High Warning	1 ~ 125%	Reading at which a warning occurs. Percentages based on the Rated Amps value.
Setpoints -> High Failure	1 ~ 125%	Reading at which a failure occurs. Percentages based on the Rated Amps value.

4.6.3.2 IDMT

Sets a inverse time trip curve for over-current. When set this overrides the Over Current Failure.

Name	Range	Description
IDMT Mode	Disable Breaker Trip Shutdown Trip	**Disable**: Disables the IMDT feature. **Breaker Trip**: If IDMT is active the Breaker Trip switched output is activated to switch off the main generator breaker. This is a latching feature. The operator must press the ▲ and ▼ keys to reset the feature. **Shutdown Trip**: shuts down the engine.
TDS (Time Dial Setting)	0.1 ~ 30	Sets the slope of the IDMT curve. This controls the sensitivity of the trip to over current.
Reset Time	1 ~ 600 seconds	How long the current must drop and stay below the rated current to reset the IDMT.

The equation for the IDMT is given as:

$$(t_r)_m = \frac{TDS * 13.5}{\frac{I}{Is} - 1}$$

Where,

TDS is the time dial setting above.
$\mathbf{I_s}$ is the Rated Current (A).
I is the actual current measured by the controller (A).
$\mathbf{(t_r)_m}$ is the trip time in seconds.

For example with a Rated Current of 100A and a TDS of 0.1 the IDMT will trigger in:
0.15s if the actual generator current is 1000A.
1.35s if the actual generator current is 200A.
6.75s if the actual generator current is 120A.

4.6.3.3 Load Imbalance

Load imbalance provides protection against differences in phase currents.

Name	Range	Description
Load Imbalance Mode	Disable Breaker Trip Shutdown Trip	**Disable**: Disables the Load Imbalance feature. **Breaker Trip**: If Load Imbalance is active the Breaker Trip switched output is activated to switch off the main generator breaker. This is a latching feature. The operator must press the ▲ and ▼ keys to reset the latch. **Shutdown Trip**: shuts down the engine.

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Name	Range	Description
Load Imbalance %	1 ~ 200%	The percentage of rated current where if any phase is above this trigger load imbalance.
Load Imbalance Delay	1 ~ 600 seconds	The length of time to allow an imbalance before triggering (trip, shutdown).

The load imbalance formula is given as:

For three phase:

$$max\{|I_A - I_B|, |I_A - I_C|, |I_B - I_C|\} > Rated\ Amps \times Phase_Imbalance_Threshold(\%)$$

For single phase:

$$|I_1 - I_2| > Rated\ Amps \times Phase_Imbalance_Threshold(\%)$$

Where,

I_A,I_B, and I_C are the actual current measured by the controller.

Note: Phase Imbalance is the same as load imbalance.

4.6.3.4 Dummy Load

The dummy load feature can be enabled to prevent wet stacking.

Name	Range	Description
Bypass	Disabled, 1 ~ 120 seconds	The amount of time to delay before applying the dummy load.
Load On	Disabled, 1 ~ 500A	The threshold below which the dummy load is applied. There is a 4s debounce time. The bypass time must expire before the load is applied. All phases must drop below this threshold to trigger dummy load.
Load Off	Disabled, 1 ~ 500A	The threshold above which the dummy load is removed. Dummy load is turned off if one phase rises above this threshold.

One of the switched outputs must also be set to dummy load. The output is only turned on when the engine is running.

4.7 Communications

The controller has the ability to communicate with other systems over communication buses. The following sections relate to settings associated with communications.

4.7.1 CAN Bus (J1939)

For detailed information about J1939 settings and functions please use the J1939 Reference Manual. The manual can be found at www.dynagen.com/support.

Name	Range	Description
ECM Model	Generic J1939 John Deere JDEC Volvo EMS This is not a complete list. See the J1939 User Manual for the full list.	Choose one of the compatible ECM modules from the list.
ECM Communication Failure	Enable ~ Disable	If no CAN messages are received for more than 6 seconds, the controller shuts down the engine.

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Name	Range	Description
DTC Display	Enable ~ Disable	Enables or disables active fault messages (DM1) monitoring.
Active DTC Log	Enable ~ Disable	Enables or disables the storing of active faults (DM1).
Read Stored DTC	Enable ~ Disable	Enables or disables the ability to request stored fault codes from the ECM (DM2).
Auto Power ECM	Enable ~ Disable	When enabled, the fuel relay is enabled in Auto mode so that the ECM is already booted up and initialized before the user decides to start the engine.
ECM Power Delay	5 ~ 30 seconds	Used in conjunction with Auto Power ECM. When the engine shuts down, the controller waits for the time specified by the ECM Power Delay before turning on the fuel relay. This prevents unwanted start ups due to the engine not being completely shut down.
Cummins PGNs	Enable ~ Disable	Enables or disables the broadcasting of PGNs required by Cummins engines.
SPN Conversion	Version 1 Version 2 Version 3	Select the SPN conversion method.
EMS2B Frequency Select	Primary Secondary	For Volvo EMS2B Engine Control Modules only.
EMS2B Accelerator Pedal	40.0 ~ 60.0%	For Volvo EMS2B Engine Control Modules only.

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4.7.2 MOD Bus (RS485)

The Modbus functionality on the controller provides interface ability to PLCs, SCADA and building management systems. For detailed information about the Modbus registers and their interpretations please use the Modbus Reference Manual. The manual can be found at www.dynagen.com/support.

Name	Description	Range / Values
Device Address	The device address of the controller.	1 ~ 247
Baud Rate (BPS)	The speed at which the controller (slave) communicates with the master.	9600, 19200, 38400, 57400
Communication Protocol	The controller always communicates in Modbus RTU.	Modbus RTU (Fixed)
Slave / Master Configuration	The controller is always the slave and must be queried by the master.	Slave (Fixed)

5 Troubleshooting

If you are having issues with your controller, please refer to the table below for a solution before contacting technical support.

Issue	Solution
Engine starts but the crank output does not turn off	The controller is not receiving a speed signal. 1. Verify the Sensors -> Engine Speed -> Signal Source setting is set correctly. 2. Verify the Timers -> Engine Logic -> RPM Disconnect setting is set correctly. 3. Ensure the correct wiring to the controller. For magnetic pickup, Speed Sensing A and B terminals are used. For generator voltage, the AC voltage connections are used.
Sensor always displays its lowest or highest value	The sensor could either be open (not connected) or shorted to ground. Verify your connections and ensure the correct sender table is loaded.

Contacting DYNAGEN can be done by any of the methods below. Technical support is offered Monday - Friday, 8:00am - 4:00pm (EST). If you are unable to contact one of our engineers, please leave a message and they will return your call as soon as possible.

Type	Information
Website	www.dynagen.ca/support
Email	support@dynagen.ca
Phone Number	(902) 406-0133
Twitter	@DynaGenTech
Facebook	www.facebook.com/DYNAGEN
Address	3 Spectacle Lake Drive, Unit B105 Dartmouth, NS B3B1W8, Canada

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